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ROBBIN L. MILLER
Project Engineer
robbin.miller@wpafb.af.mil
DSN 787-73362
Comm (937) 257-3362

SUSAN J. EVANS
Qualification Test Engineer
susan.evans@wpafb.af.mil
DSN 787-7445
Comm (937) 257-7445

Development of the C-17 Heads-Up Display Unit Container, *CNU-676/E*

AFMC LSO/LOP
AIR FORCE PACKAGING TECHNOLOGY & ENGINEERING FACILITY
WRIGHT PATTERSON AFB, OH 45433-5540
January 27 2006

NOTICE

AFPTEF PROJECT NO. 04-P-106
TITLE: Development of the C-17 Heads-Up Display Unit Container

ABSTRACT

The Air Force Packaging Technology and Engineering Facility (AFPTEF) was tasked with the design of a new shipping and storage container for the C-17 Heads-Up Display (HUD) unit in March of 2004. The new container is designed to replace the wood/fiberboard combination package presently used.

The current containers' lack of mechanical and environmental protection as well as handling issues prompted AFPTEF's design of a new container. The new container will protect the HUD both mechanically and environmentally and make it easier to maneuver during worldwide shipment and storage. The CNU-676/E, designed to SAE ARP1967A, is an aluminum, long-life, controlled breathing, reusable shipping and storage container. The new container passed all qualification tests per ASTM D4169.

The CNU-676/E container will not only meet the users' requirements but will also provide an economic saving for the Air Force. The savings will be thousands of dollars over the twenty-year life span of the container.

Total man-hours: 500

PROJECT ENGINEER:

Robbin L. Miller
Mechanical Engineer
AFPTEF

TEST ENGINEER:

Susan J. Evans
Mechanical Engineer
AFPTEF

APPROVED BY:

Robbin L. Miller
Chief, Air Force Packaging
Technology & Engineering Facility

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INTRODUCTION

BACKGROUND – The C-17 Sustainment group (564 ACSS/GFL) located at Robins AFB requested the Air Force Packaging Technology and Engineering Facility (AFPTEF) develop a long-life aluminum container for the Heads-Up Display (HUD) unit. The container is a replacement for the current wood/fiberboard combination box which uses foam cushioning and a barrier bag for shock and environmental protection. The current packaging degrades readily during use and can not be stored outside. The box provides inadequate environmental and shock protection for the HUD. The HUD container is one of a family of new AFPTEF container designs to protect C-17 items that are being damaged in the shipping and storage cycle. Containers were also designed for the main landing gear (MLG) axle beams, MLG posts, full MLG assemblies, nose landing gear assembly, nose radome, brake assembly, OBIGGS winch, and fan thrust reversers.

REQUIREMENTS – AFPTEF, Boeing, and Robins AFB personnel agreed upon a list of requirements during initial design discussions. Many of these requirements were not met by the current wood/fiberboard combination box. The requirements are as follows:

- Sealed/controlled-breathing container that protects against varied environmental conditions and weather during either inside or outside shipping and storage
- No loose packing material
- Shock/Vibration limited to 30 Gs
- Reusable and designed for long life (20 years)
- Low maintenance
- Field repairable hardware
- Forklift capabilities

DEVELOPMENT

DESIGN – The C-17 HUD Shipping and Storage Container, CNU-676/E, design meets all the users' requirements. The CNU-676/E is a sealed, welded aluminum, controlled breathing, reusable container (see Appendix 2, Figure 1). The container is engineered for the physical and environmental protection of the HUD during worldwide transportation and storage. The container consists of a low profile base and completely removable cover equipped with the special features listed below. Guide posts (see Appendix 2, Figure 2) keep the cover from swinging into the HUD during cover removal and replacement. The base is a one piece skid/double walled base extrusion with 4-way forklift openings, humidity indicator, pressure equalizing valve (1.5 psi pressure/1.5 psi vacuum) and desiccant port for easy replacement of desiccant (controls dehumidification). The ability of the container to control/eliminate humidity inside the container eliminates the requirement for a barrier bag which is required in the current package. A silicone rubber gasket and quick release cam-over-center latches create a water/air-tight seal at the base-cover interface. Container external dimensions are 45 inches in length, 22.6 inches in width, and 22.6 inches in height. Container empty weight is 93 pounds, and 143 pounds with a HUD in place.

An aluminum cradle system is integrated into the base suspended on four stainless steel helical isolators that provide shock and vibration protection to 30 G's (See Appendix 2, Figure 2). The HUD sets in the cradle system and two bars are rotated over the HUD, on opposite ends, and tightened with knobs to secure the HUD to the cradle system. Silicone rubber pads provide friction to keep the HUD from sliding on the aluminum surfaces and also provides abrasion protection from metal edges. The cradle allows easy loading and unloading of the HUD as well as brings it slightly above the base assembly for easy inspection and possible repair capabilities while still in the container. There are no detachable parts on the container other than the container lid, which eliminates FOD risks.

HUD CONTAINER FEATURES	
Pressure Equalizing Valve	1
Humidity Indicator	1
Desiccant Port	1
Document Receptacle	None
Forkliftable	Yes
Cover Latches	10
Cover Lift Handles	2
Cover Lift Rings	None
Cover Tether Rings	None
Base Lift Handles	None
Base Tie-down Rings	4
Stacking Capability	Yes

PROTOTYPE – AFPTEF fabricated one CNU-676/E prototype container in house for testing. The prototype container was fabricated in accordance with (IAW) all requirements and tolerances of the container drawing package. The drawing package used for prototype fabrication has been released for the manufacture of production quantities of the container. Each face of the container was uniquely identified for testing identification as shown below.

DESIGNATED SIDE	**CONTAINER FEATURE**
Top	Cover Top
Aft	Desiccant Port
Right	Right Side from Aft
Left	Left Side from Aft
Forward	Opposite Aft
Bottom	Base Bottom

QUALIFICATION TESTING

TEST LOAD – The test load was an actual HUD. A triaxial accelerometer, used to record actual accelerations sustained by the HUD, was mounted on the test load as close to the center of mass as possible. The test load weight was 50 lbs.

TEST PLAN – The HUD container was tested in accordance with AFPTEF's standard long life container test plan (See Appendix 1). The test plan referenced ASTM D 4169 and SAE ARP 1967. The test methods specified in this test plan constituted the procedure for performing the tests on the HUD container. The performance criteria for evaluation of the container acceptability was specified at 30 Gs maximum and an initial and final leak rate of 0.34 kPa (0.05 psi) per hour at 10.34 kPa (1.5 psi). These tests are commonly applied to special shipping containers providing rough handling protection to sensitive items. The tests were performed at AFPTEF, AFMC LSO/LOP, 5215 Thurlow St, Wright-Patterson AFB, OH 45433-5540.

ITEM INSTRUMENTATION – The test load was instrumented with a piezoelectric triaxial accelerometer mounted as close as possible to the HUD's center of mass. Accelerometer positive axis orientations were as follows:

X Axis - Directed through container Forward and Aft sides (Longitudinal motion).
Y Axis - Directed through container Left and Right sides (Transverse motion).
Z Axis - Directed through container Top and Bottom (Vertical motion).

See Appendix 4 for detailed accelerometer and other instrumentation information.

TEST SEQUENCES – Note: All test sequences were performed at ambient temperature and humidity, unless otherwise noted in the test procedure.

TEST SEQUENCE 1 – Leak Test

Procedure – The desiccant port cover was removed and replaced with a port cover modified for attachment of the digital manometer and vacuum/pressure pump lines. The container was closed and sealed. The pneumatic pressure leak technique was used to pressurize the container to a minimum test pressure of 10.34 kPa (1.5 psi). Maximum allowable leak rate is 0.34 kPa (0.05 psi) per hour. (See Appendix 2, Figure 3)

Results – The container passed the leak test with a leak rate less than the maximum allowed rate of 0.34 kPa (0.05 psi) per hour.

TEST SEQUENCE 2 – Vibration Test, Resonance Dwell

Procedure – The container was rigidly attached to the vibration platform (see Appendix 2, Figure 4). A sinusoidal vibration excitation was applied in the vertical direction and cyclically swept for 7.5 minutes at 2 minutes per octave to locate the resonant frequency. Input vibration from 5 to 12.5 Hertz (Hz) was at 0.125-inch double amplitude. Input vibration from 12.5 to 50.0 Hz was at 1.0 G (0 to peak). The peak transmissibility values during the up and down frequency sweeps were noted for use in determining the frequency search range for the resonance dwell test.

Acceleration pulses were recorded to determine the maximum accelerations sustained by the packaged item. All signals were electronically filtered using a two-pole Butterworth filter with a 600 Hz cutoff frequency.

The vibration controller swept up the frequency range until the resonant frequency was reached. The controller locked onto and tracked this frequency for the 30 minute resonance dwell test. The resonant frequency and corresponding transmissibility at 1 minute, 15 minutes and 30 minutes into the test were recorded. The test was conducted at ambient temperature.

Results – The initial resonant frequency of the container was 17.3 Hz. The controller was manually locked onto this frequency, and a manually controlled check for a change in the resonant frequency was performed every 10 minutes for the duration of the 30 minute resonance dwell test. During this period, the resonant frequency shifted to 17.8 Hz, and ended at 17.5 Hz; the average transmissibility of the container and cradle/shock mount system was 0.8. This is lower than the maximum allowable transmissibility, 8, when the resonant frequency is between 15 and 25 Hz (see Appendix 3, Table 2, Resonance Sweep and Dwell Graphs, and frequency/transmissibility tables at the end of Appendix 3). The container met the test requirements.

TEST SEQUENCE 3 – Loose Load Vibration, Repetitive Shock

Procedure – A sheet of 3/4-inch plywood was bolted to the top of the vibration table, and the container was placed on the plywood. Restraints were used to prevent the container from sliding off the table. The container was allowed approximately 1/2-inch unrestricted movement in the horizontal direction from the centered position on the table (see Appendix 2, Figure 5).

The table frequency was increased from 3.5 Hz until the container left the table surface (approximately 3.9 Hz). At one-inch double amplitude, a 1/16-inch-thick flat metal feeler could be slid freely between the table top and the container under all points of the container. Repetitive shock testing was conducted for 2 hours at ambient temperature.

Results – The loaded container was vibrated at 4.3 Hz for 2 hours. The maximum G level (vertical axis) measured during this time was 1.9. At the end of testing there was no visible damage to the either the container or the item. (see Appendix 3, Repetitive Shock Graphs) The container met the test requirements.

TEST SEQUENCE 4 – Rotational Drops

Procedure – An Assurance Level I drop height of 762 mm (30 in.) was used to perform four corner and four edge drops onto a one-inch thick steel plate, the impact levels were recorded. The maximum allowed impact level for the HUD was 30 Gs. (See Appendix 2, Figures 6 & 7.)

Results – There was no noticeable damage to either the container or item. The maximum recorded (resultant) impacts ranged from 9 Gs to 24 Gs, well below the item fragility of 30 Gs. (See Appendix 3, Table 1 and Corner and Edge Drop Graphs). The container met the test requirements.

TEST SEQUENCE 5 – Lateral Impact (Pendulum Impact)

Procedure – The container impact velocity was 2.13 m/sec. Each of the four container sides was impacted one time. (See Appendix 2, Figure 8.)

Results – No noticeable damage occurred to the container or item. The item did not make contact with any interior container surfaces during testing. The maximum recorded (resultant) impacts ranged from 11 Gs to 13 G's, well below the item fragility of 30 Gs. (See Appendix 3, Table 1 and Lateral Impact Graphs) The container met the test requirements.

TEST SEQUENCE 6 – Leak Test

Procedure – Test Sequence 1 was repeated.

Results – The container passed the leak test with a leak rate less than the maximum allowed rate of 0.34 kPa (0.05 psi) per hour.

TEST CONCLUSIONS – No damage occurred during the above testing to either the container, mounting system, or test item. There was no evidence of any contact on impact between the HUD and the container walls or cover. All impact levels are well below the item fragility limit of 30 Gs. Therefore, the container and mounting system do provide adequate protection for the HUD.

FIT & FUNCTION TESTING

Fit and function testing was completed on site at AFPTEF with the HUD that was supplied for prototype testing.

CONCLUSIONS

No damage occurred during the above testing to the container, mounting system or test item. There was no evidence of any contact on impact between the radome and the container walls or cover. All impact levels are well below the item fragility limit of 30 G's. The CNU-676/E aluminum container was accepted by the users. The container met all the user's requirements. The container can protect a HUD during world-wide transportation and storage and will save the Air Force hundreds of thousands of dollars in O&M costs.

RECOMMENDATIONS

AFPTEF recommends that new containers be procured and delivered to avoid damage to HUD units, thus mitigating overall shipping risks. All wood/fiberboard combination boxes for the HUD units should be replaced.

APPENDIX 1: Test Plan

AIR FORCE PACKAGING EVALUATION ACTIVITY (Container Test Plan)					AFPEA PROJECT NUMBER: 04-P-106	
CONTAINER SIZE (L x W x D) (MILLIMETERS) INTERIOR:	EXTERIOR:	WEIGHT (Kgs) GROSS:	ITEM:	CUBE (CU. M)	QUANTITY:	DATE:
1053 X 483 X 446.3	1143 X 573 X 573.7	65	23	.38	1	12 JUL 04
ITEM NAME: C-17 Heads-Up Display Unit (HUD)				MANUFACTURER: AFPTEF		
CONTAINER NAME: C-17 HUD Container					CONTAINER COST:	
PACK DESCRIPTION: Extruded Aluminum Cntr., Aluminum Cradle, Helical Isolators, Test Load of a C-17 HUD						
CONDITIONING: As noted below						

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
		NOTE No damage to contents is acceptable and Package must be in serviceable condition. Serviceable means remains sealed, with no deformities, etc.		
		Quality Conformance Tests.		
1.	**Examination of Product.**			
	ARP1967 Par. 4.5.1 Table I	Container shall be carefully examined to determine conformance with material, workmanship, and requirements as specified in Table and drawings.	Ambient temp.	Visual Inspection (VI)
2.	**Weight Test.**			
	ARP1967 Par. 4.5.8.3.7	Container shall be weighed.	Ambient temp.	Scale
		Performance Tests.		
3.	**Leak Test.**			
	ARP1967 Par. 4.5.2	Pneumatic pressure at 10.34 kPA and vacuum retention at -10.34 kPA. After temperature stabilization, pressure drop shall not exceed 0.34 kPA per hour. Test shall last a minimum of 30 minutes.	Ambient temp.	Water Manometer (WM) or Pressure Transducer (PPT)
4.	**Vibration Test.**			
a.	**ARP1967 Par. 4.5.5 ASTM D4169 ASTMD999**	The container shall be vibrated from 5 Hz to 50 Hz at a sweep rate of one half octave per minute with a total sweep time of 7.5 minutes. Container shall then be vibrated for 30 minutes at the predominant resonance. Input excitation shall be 3.2mm double amplitude or 1 G whichever is less.	Ambient temp. Rigidly attach container to exciter.	VI Tri-axial accelerometer

COMMENTS:

PREPARED BY:	APPROVED BY:
Robbin Miller, Mechanical Engineer	Robbin Miller, Chief AFPTEF

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AIR FORCE PACKAGING EVALUATION ACTIVITY (Container Test Plan)					AFPEA PROJECT NUMBER: 04-P-106	
CONTAINER SIZE (L x W x D) (MILLIMETERS) INTERIOR:	EXTERIOR:	WEIGHT (Kgs) GROSS:	ITEM:	CUBE (CU. M)	QUANTITY:	DATE:
1053 X 483 X 446.3	1143 X 573 X 573.7	65	23	.38	1	12 JUL 04
ITEM NAME: C-17 Heads-Up Display Unit (HUD)				MANUFACTURER: AFPTEF		
CONTAINER NAME: C-17 HUD Container					CONTAINER COST:	
PACK DESCRIPTION: Extruded Aluminum Cntr., Aluminum Cradle, Helical Isolators, Test Load of a C-17 HUD						
CONDITIONING: As noted below						

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
b.	**ARP 1967 Par. 4.5.5 ASTM D4169 ASTM D999**	Container shall be vibrated IAW ASTM D4169, Method D999 for not less than two hours.	Ambient temp. Blocking shall be used to keep cntr. In place, do not restrict vertical or rotational move-ment.	VI Tri-axial accelerometer
5.	**Rough Handling Tests (Ambient Temperature)**			
a.	**ARP1967 Par. 4.5.3.2 ASTM D4169 ASTM D6179**	Corner-wise drop (rotational) test. Drop height: 762mm. Item shall not sustain more than 30G's.	One drop on each bottom corner. Total of four drops.	VI Tri-axial accelerometer
b.	**ARP1967 Par. 4.5.3.1 ASTM D4169 ASTM D6179**	Edge-wise drop (rotational) test. Drop height: 762mm. Item shall not sustain more than 30G's.	One drop on each bottom edge. Total of four drops.	VI Tri-axial accelerometer
c.	**ARP1967 Par. 4.5.6 ASTM D4169 ASTM D880**	Lateral-Impact test. Impact velocity 2.13 m/sec. Item shall not sustain more than 30G's.	One impact on each side and end. Total of four impacts.	VI Tri-axial accelerometer

COMMENTS:

PREPARED BY:	APPROVED BY:
Robbin Miller, Mechanical Engineer	Robbin Miller, Chief AFPTEF

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AIR FORCE PACKAGING EVALUATION ACTIVITY (Container Test Plan)					AFPEA PROJECT NUMBER: 04-P-106	
CONTAINER SIZE (L x W x D) (MILLIMETERS) INTERIOR:	EXTERIOR:	WEIGHT (Kgs) GROSS:	ITEM:	CUBE (CU. M)	QUANTITY:	DATE:
1053 X 483 X 446.3	1143 X 573 X 573.7	65	23	.38	1	12 JUL 04
ITEM NAME: C-17 Heads-Up Display Unit (HUD)				MANUFACTURER: AFPTEF		
CONTAINER NAME: C-17 HUD Container					CONTAINER COST:	
PACK DESCRIPTION: Extruded Aluminum Cntr., Aluminum Cradle, Helical Isolators, Test Load of a C-17 HUD						
CONDITIONING: As noted below						

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU-MENTATION
6.	**Leak Test.**			
	ARP1967 Par. 4.5.2	Pneumatic pressure at 6.9kPA and vacuum retention at -6.9kPA. After temperature stabilization, pressure drop shall not exceed 0.35kPA per hour. Test shall last a minimum of 30 minutes.	Ambiant temp.	Water Manometer (WM) or Pressure Transducer (PPT)

COMMENTS:	
PREPARED BY: Robbin Miller, Mechanical Engineer	APPROVED BY: Robbin Miller, Chief AFPTEF

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APPENDIX 2: Fabrication & Testing Photographs

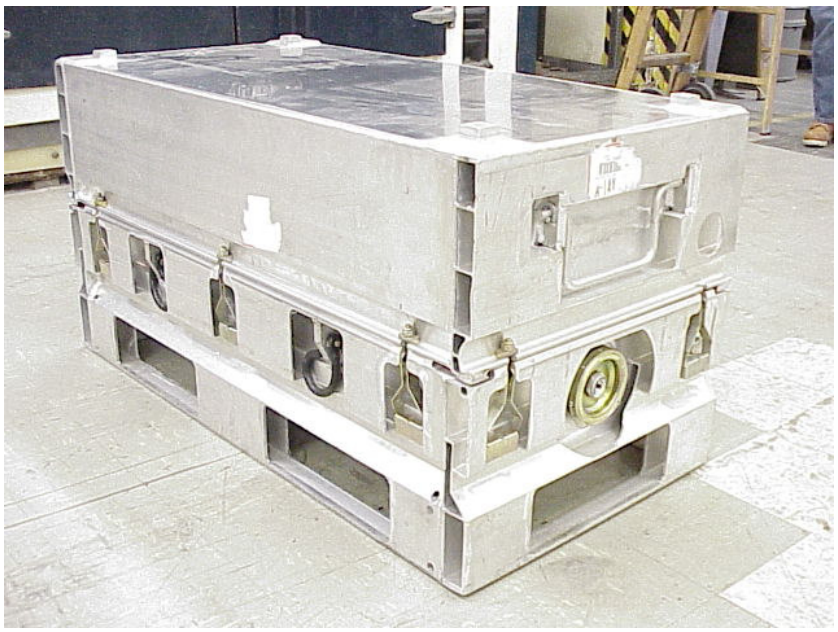


Figure 1. HUD Container

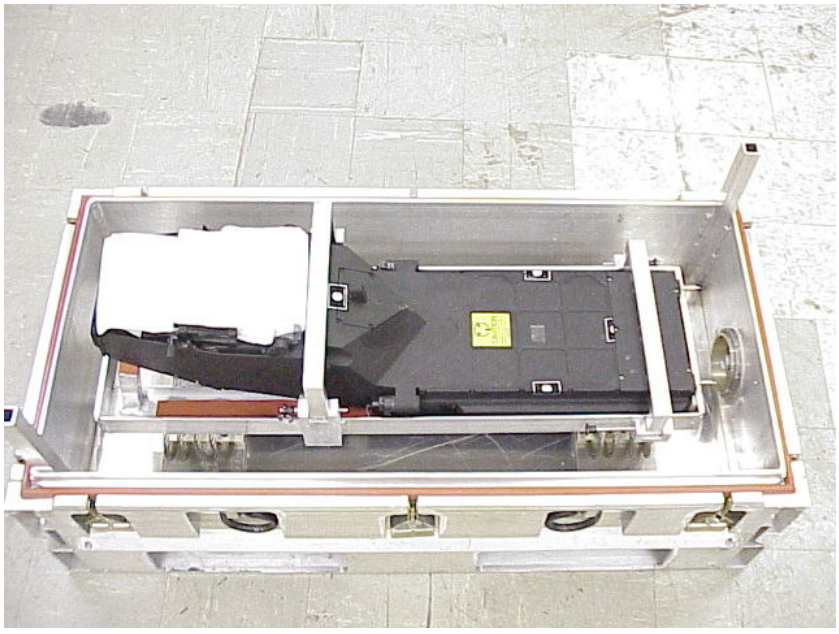


Figure 2. HUD Container w/Cover Removed showing Cradle System and Guide Posts

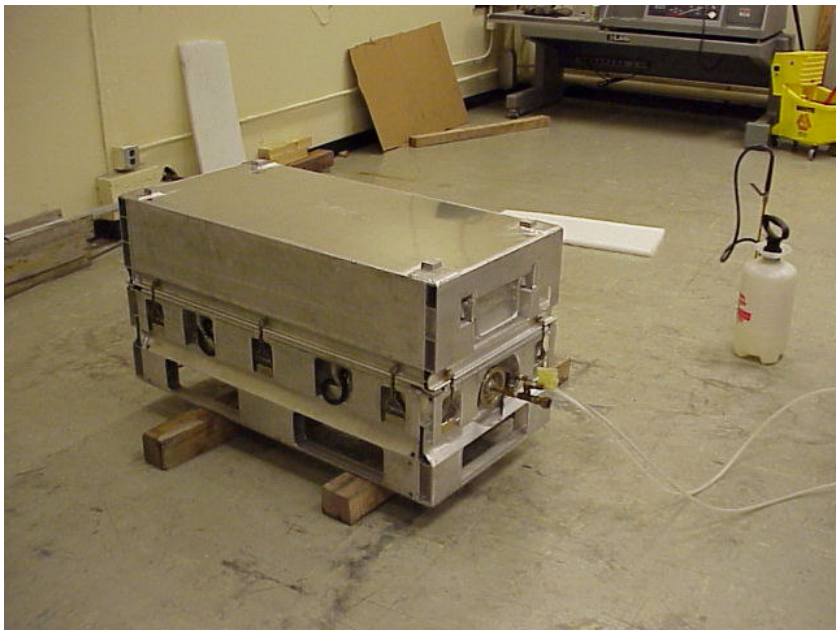


Figure 3. Leak Test

Figure 4. Vibration Test, Resonance Dwell

Figure 5. Vibration Test, Repetitive Shock

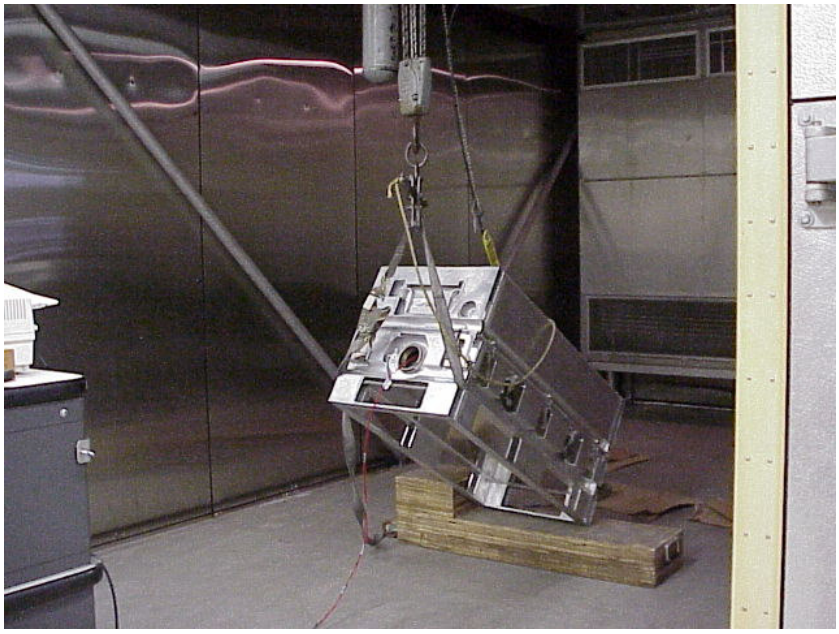


Figure 6. Rough Handling Test, Rotational Edge Drop

Figure 7. Rough Handling, Rotational Corner-Wise Drop

Figure 8. Rough Handling Test, Lateral Impact

APPENDIX 3: Test Data

Table 1. Impact Test Summary

IMPACT TYPE	TEST TEMPERATURE	IMPACT LOCATION	RESULTANT PEAK G
ROTATIONAL - CORNER	ambient	forward-left	15
ROTATIONAL - CORNER	ambient	forward-right	12
ROTATIONAL - CORNER	ambient	aft-left	16
ROTATIONAL - CORNER	ambient	aft-right	16
ROTATIONAL - EDGE	ambient	forward-bottom	12
ROTATIONAL - EDGE	ambient	aft-bottom	24
ROTATIONAL - EDGE	ambient	left-bottom	12
ROTATIONAL - EDGE	ambient	right-bottom	9
LATERAL IMPACT - FACE	ambient	forward	11
LATERAL IMPACT - FACE	ambient	aft	13
LATERAL IMPACT - FACE	ambient	left	12
LATERAL IMPACT - FACE	ambient	right	13

Table 2. Container Resonant Frequency and Transmissibility Values.

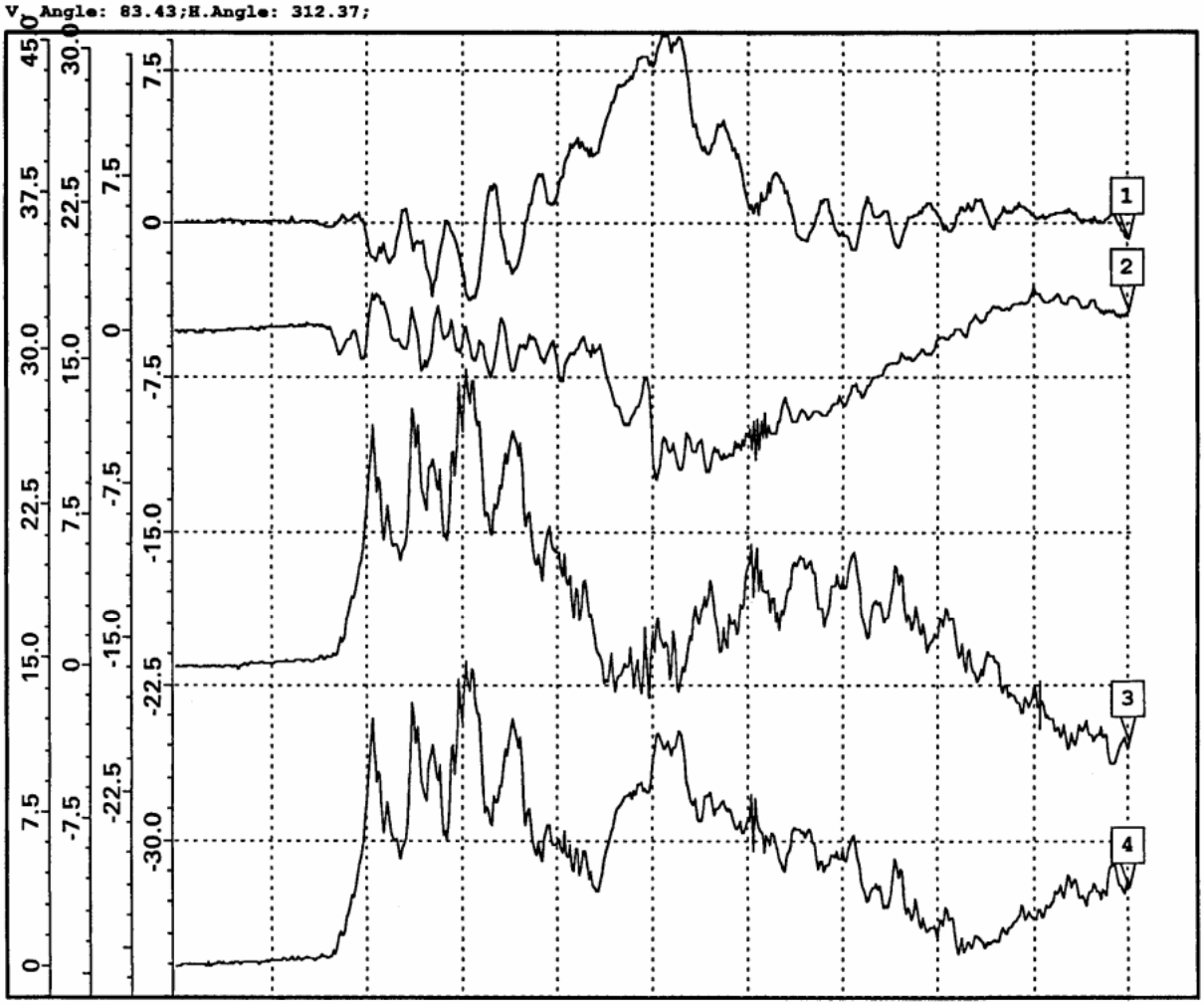
TEST TEMPERATURE	DWELL TIME	RESONANT FREQUENCY	TRANSMISSIBILITY
Ambient	1 min	17.3 Hz	0.8
Ambient	15 min	17.76 Hz	0.8
Ambient	30 min	17.69	0.8

C17 Heads Up Display

ROTATIONAL IMPACT TESTS

DATE / TIME : Aug 19 2004 18:26
TEST TYPE : Ambient Temp
CONTAINER/ITEM: Al w/ Coil Mounts
TEST ENGINEER : Evans
IMPACT POINT : Frwd-left crnr
DROP HEIGHT : 762 mm (30 inches)

V. Angle: 83.43;H.Angle: 312.37;



	Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
○	1	118. mS	0.31 g's	9.44 g's	55.20 In/s	13 mS	1	2
○	2	118. mS	1.80 g's	-7.27 g's	-72.32 In/s	13 mS	1	2
◉	3	118. mS	-1.97 g's	14.52 g's	143.09 In/s	13 mS	1	2
○	R	118. mS	2.73 g's	14.89 g's	169.56 In/s	13 mS	1	2

PEAK G RESULTANT VALUE = 15 Gs. PEAK G (+Z) = 15 Gs.
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - RESULTANT. Aft side = desiccant port.
No visible damage.
ASTM D 4169, ASTM D 6179. ARP 1967.

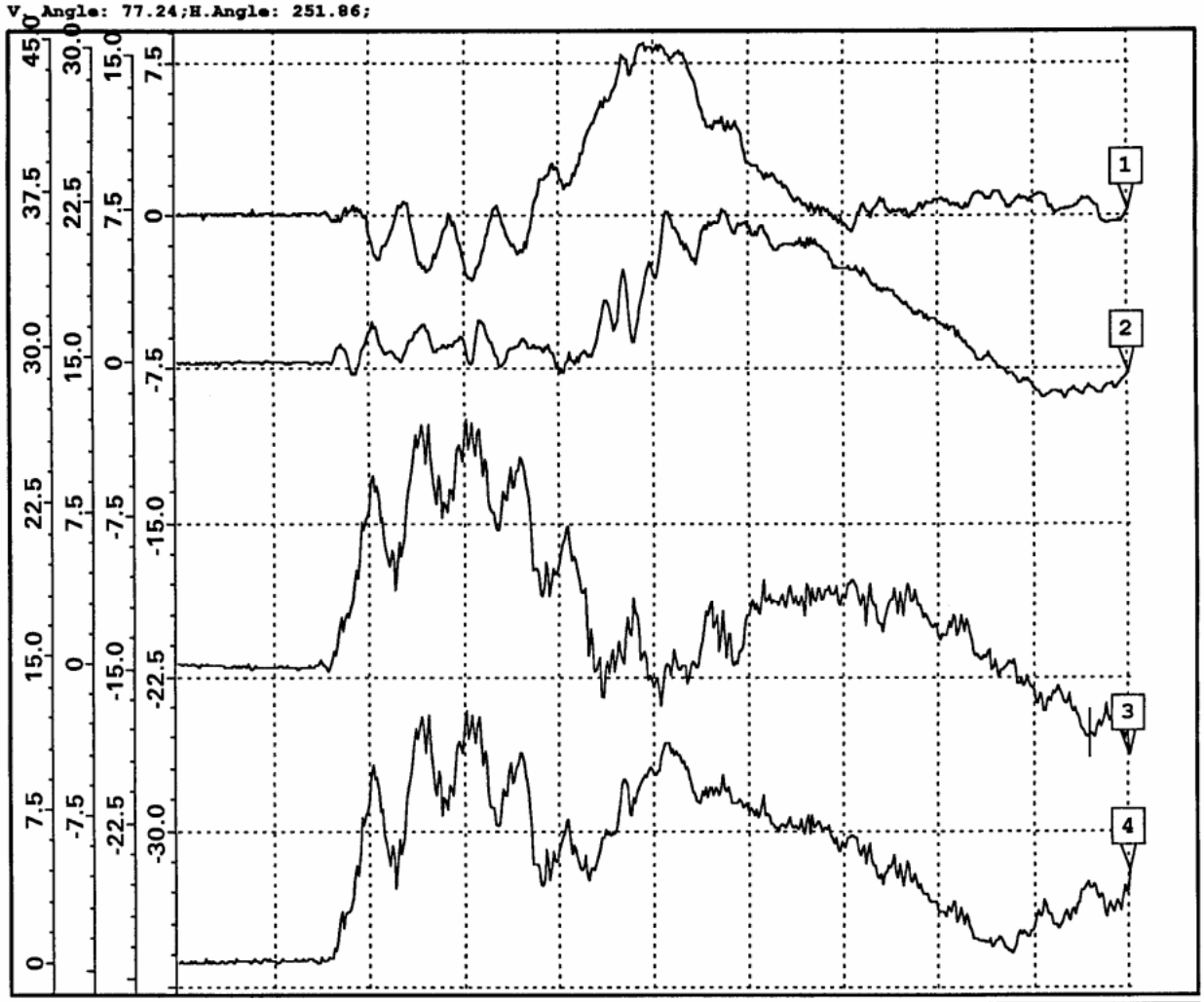
GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

ROTATIONAL IMPACT TESTS

DATE / TIME :	Aug 19 2004 18:33	TEST ENGINEER :	Evans
TEST TYPE :	Ambient Temp	IMPACT POINT :	frwd rt crnr
CONTAINER/ITEM:	Al w/ Coil Mounts	DROP HEIGHT :	762 mm (30 inches)

V. Angle: 77.24;H.Angle: 251.86;



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	125. mS	0.80 g's	8.51 g's	58.77 In/s	13 mS	1	2
2	125. mS	-1.09 g's	7.59 g's	93.62 In/s	13 mS	1	2
3	125. mS	-3.34 g's	12.10 g's	127.13 In/s	13 mS	1	2
R	125. mS	3.63 g's	12.38 g's	168.46 In/s	13 mS	1	2

PEAK G RESULTANT VALUE = 12 Gs. PEAK G (+Z) = 12 Gs.
ACCELEROMETER OUTPUT: CH1 - X; CH2 - Y; CH3 - Z; CH4 - RESULTANT.
No visible damage.
ASTM D 4169, ASTM D 6179. ARP 1967.

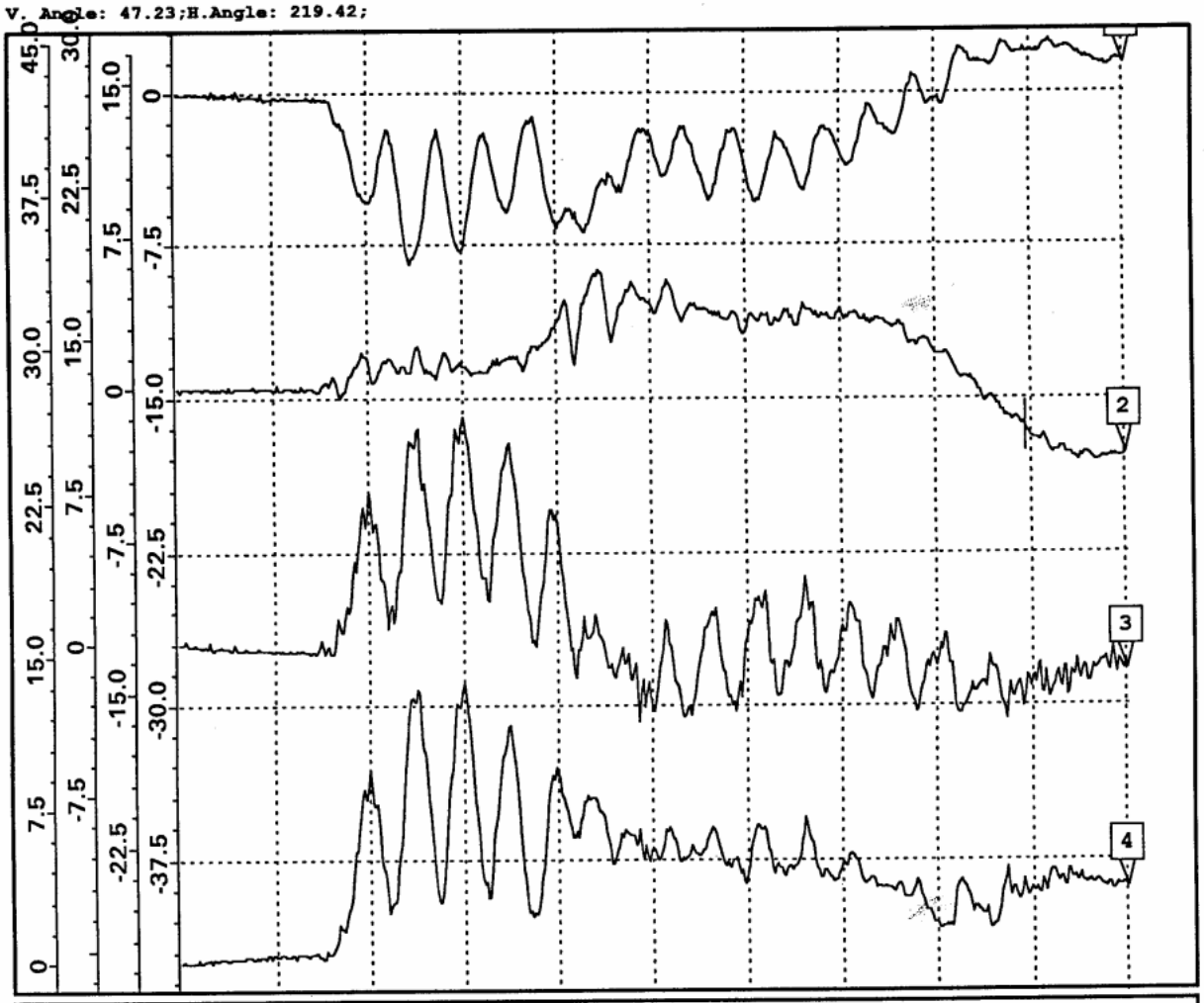
GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

ROTATIONAL IMPACT TESTS

DATE / TIME :	Aug 19 2004 18:43	TEST ENGINEER :	Evans
TEST TYPE :	Ambient Temp	IMPACT POINT :	aft left crnr
CONTAINER/ITEM:	Al w/ Coil Mounts	DROP HEIGHT :	762 mm (30 inches)

V. Angle: 47.23;H.Angle: 219.42;



	Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
○	1	116. mS	2.19 g's	-8.48 g's	-105.91 In/s	13 mS	1	2
◉	2	116. mS	-1.83 g's	5.90 g's	86.41 In/s	13 mS	1	2
○	3	116. mS	-1.50 g's	11.19 g's	41.71 In/s	13 mS	1	2
○	R	116. mS	3.26 g's	13.72 g's	142.91 In/s	13 mS	1	2

PEAK G RESULTANT VALUE = 14 Gs. PEAK G (+Z) = 11 Gs.
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(long.);
CH4 - RESULTANT. Aft side = desiccant port end.
No visible damage.
ASTM D 4169, ASTM D 6179. ARP 1967.

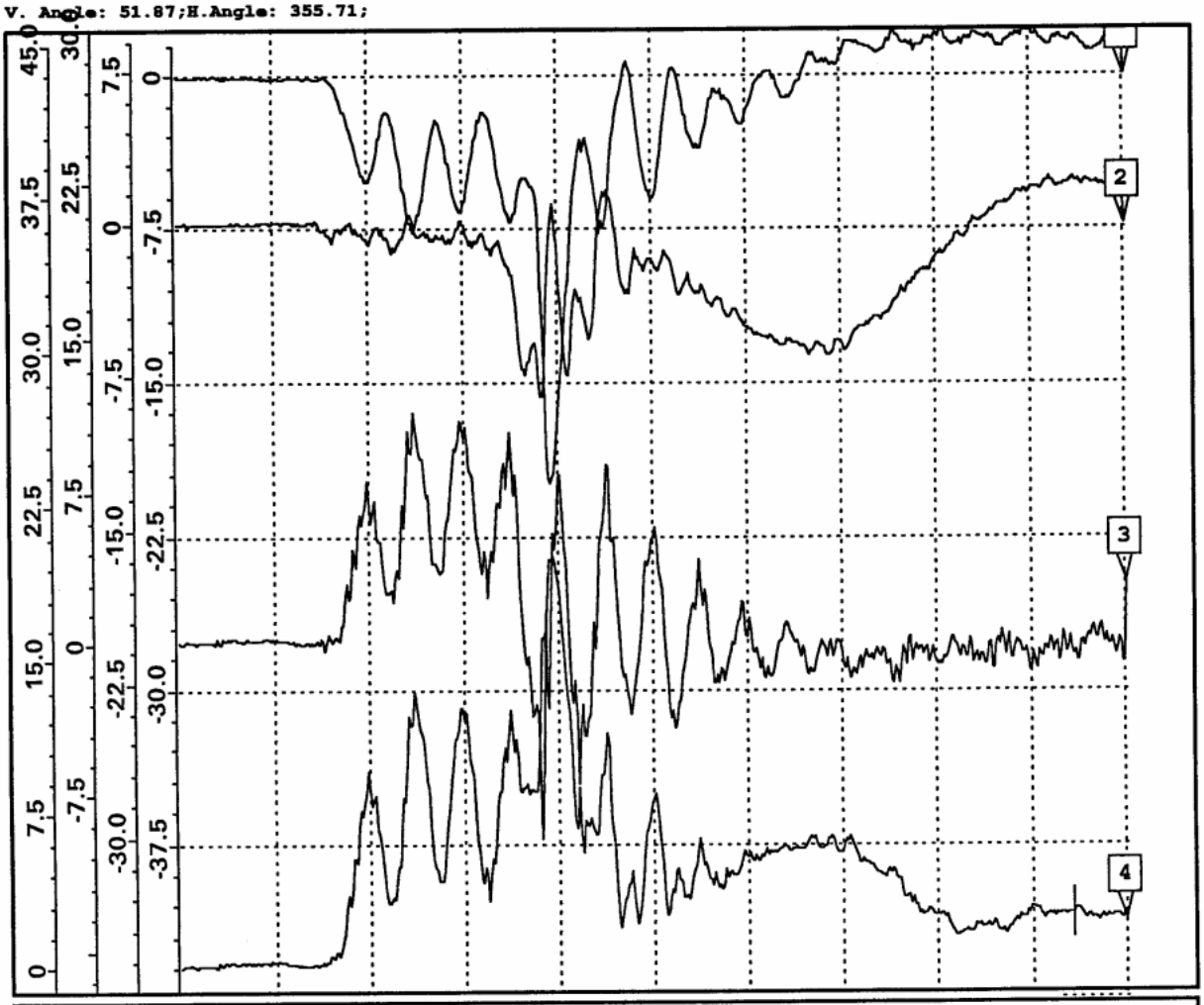
GHI SYSTEMS. INC. CAT SYSTEM

C17 Heads Up Display

ROTATIONAL IMPACT TESTS

DATE / TIME :	Aug 19 2004 18:52	TEST ENGINEER :	Evans
TEST TYPE :	Ambient Temp	IMPACT POINT :	aft rt crnr
CONTAINER/ITEM:	Al w/ Coil Mounts	DROP HEIGHT :	762 mm (30 inches)

V. Angle: 51.87;H.Angle: 355.71;



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	123. mS	1.64 g's	-19.92 g's	-78.55 In/s	13 mS	1	2
2	123. mS	2.09 g's	-8.50 g's	-89.21 In/s	13 mS	1	2
3	123. mS	-0.16 g's	11.61 g's	59.79 In/s	13 mS	1	2
R	123. mS	2.66 g's	20.46 g's	133.05 In/s	13 mS	1	2

PEAK G RESULTANT VALUE = 20 Gs. PEAK G (↔X) = 20 Gs.
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - RESULTANT. Aft side = desiccant port end.
No visible damage.
ASTM D 4169, ASTM D 6179. ARP 1967.

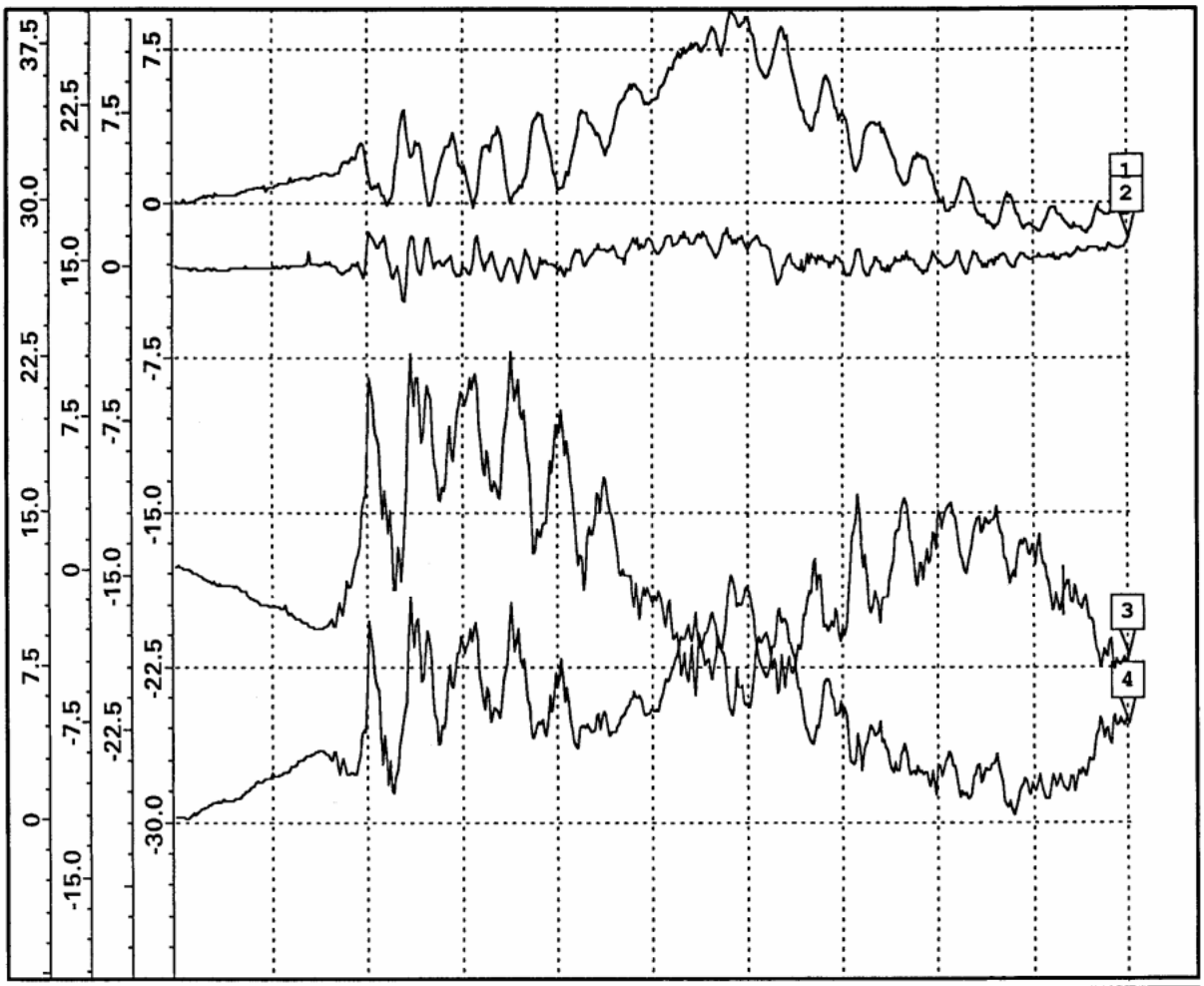
GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

ROTATIONAL IMPACT TESTS

DATE / TIME : Aug 19 2004 18:21
TEST TYPE : Ambient Temp
CONTAINER/ITEM: Al w/ Coil Mounts
TEST ENGINEER : Evans
IMPACT POINT : forward edge
DROP HEIGHT : 762 mm (30 inches)

V. Angle: 124.84;H.Angle: 293.79;



	Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
○	1	121. mS	-0.85 g's	9.55 g's	124.78 In/s	13 mS	1	2
○	2	121. mS	0.49 g's	1.97 g's	16.34 In/s	13 mS	1	2
◉	3	121. mS	-1.12 g's	10.74 g's	20.82 In/s	13 mS	1	2
○	R	121. mS	1.57 g's	11.88 g's	127.55 In/s	13 mS	1	2

PEAK G RESULTANT VALUE = 12 Gs. PEAK G (+Z) = 11 Gs.
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - RESULTANT. Aft side = desiccant port.
No visible damage.
ASTM D 4169, ASTM D 6179. ARP 1967.

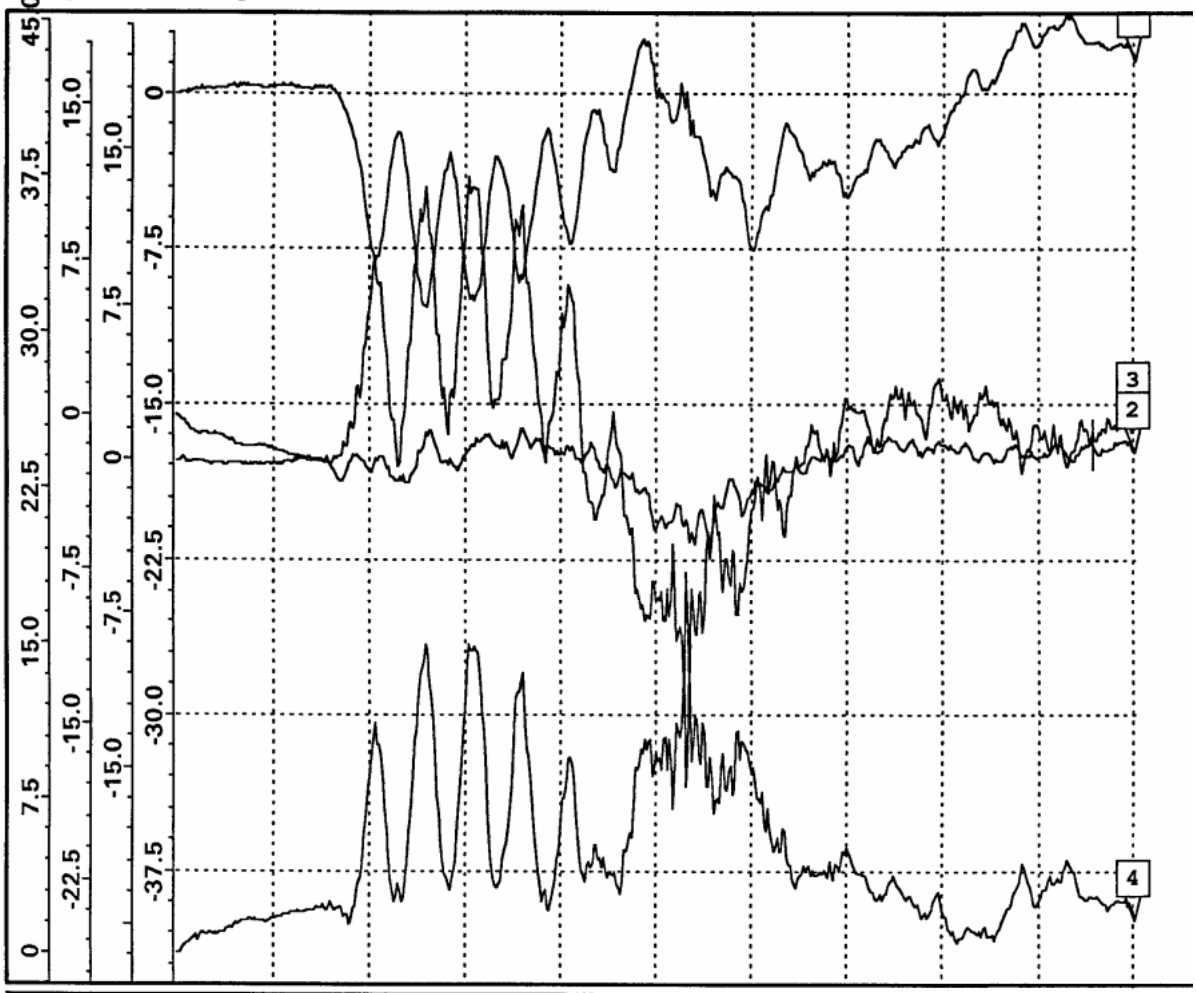
GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

ROTATIONAL IMPACT TESTS

DATE / TIME : Aug 19 2004 18:38
TEST TYPE : Ambient Temp
CONTAINER/ITEM: Al w/ Coil Mounts
TEST ENGINEER : Evans
IMPACT POINT : aft edge
DROP HEIGHT : 762 mm (30 inches)

V. Angle: 23.43;H.Angle: 310.21;



	Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
○	1	124. mS	2.46 g's	-10.37 g's	-103.11 In/s	13 mS	1	2
◉	2	124. mS	0.69 g's	-4.16 g's	-10.74 In/s	13 mS	1	2
○	3	124. mS	-0.81 g's	-13.79 g's	-42.25 In/s	13 mS	1	2
○	R	124. mS	2.70 g's	15.19 g's	111.95 In/s	13 mS	1	2

PEAK G RESULTANT VALUE = 15 Gs. PEAK G (+Z) = 14 Gs.
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - RESULTANT. Aft side = desiccant port.
No visible damage.
ASTM D 4169, ASTM D 6179. ARP 1967.

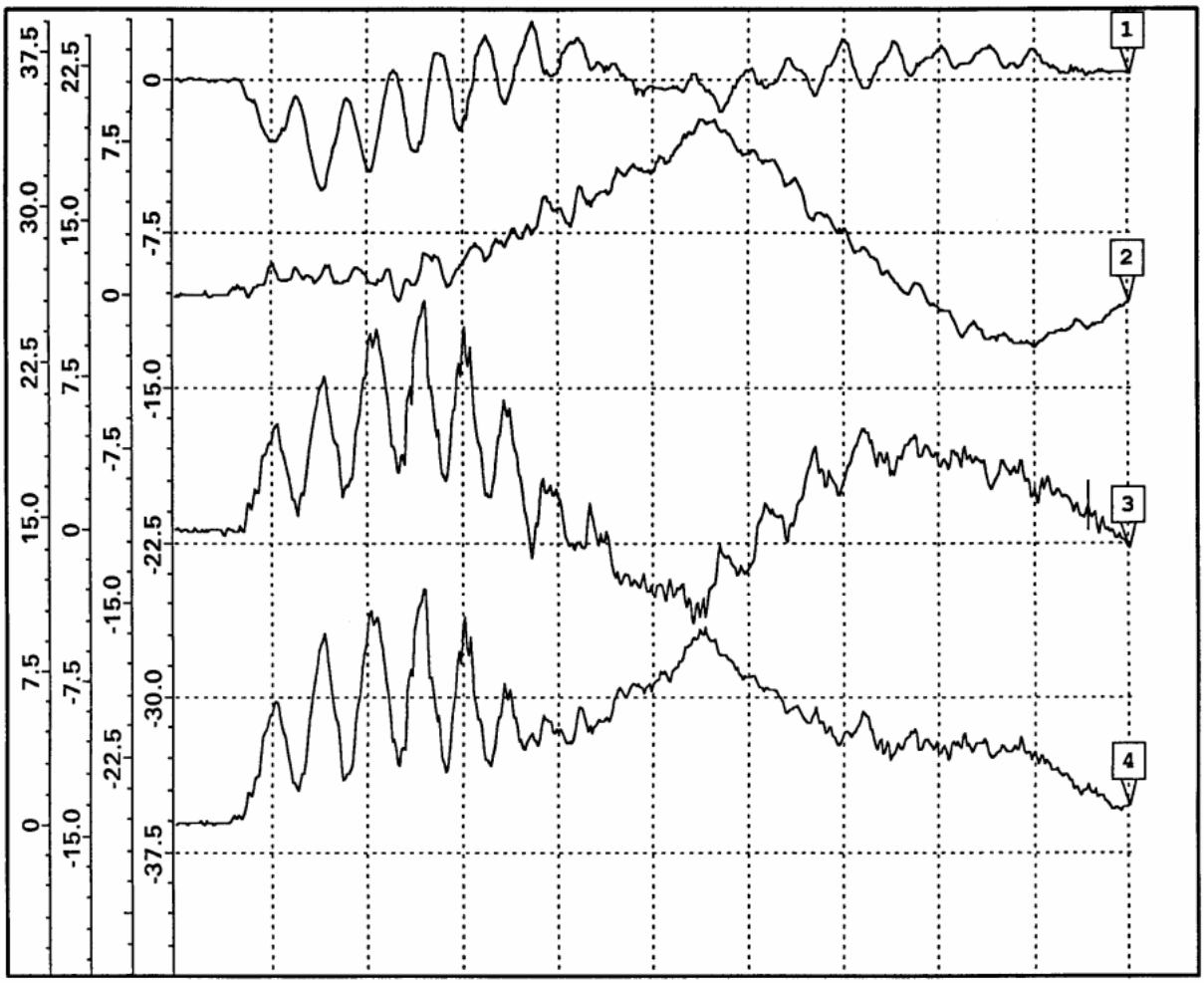
GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

ROTATIONAL IMPACT TESTS

DATE / TIME :	Aug 20 2004 6:59	TEST ENGINEER :	Evans
TEST TYPE :	Ambient Temp	IMPACT POINT :	left edge
CONTAINER/ITEM:	Al w/ Coil Mounts	DROP HEIGHT :	762 mm (25 inches)

V. Angle: 82.66;H.Angle: 145.00;



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	124. mS	0.25 g's	-5.53 g's	-6.07 In/s	13 mS	1	2
2	124. mS	-1.60 g's	8.75 g's	106.95 In/s	13 mS	1	2
3	124. mS	1.12 g's	11.23 g's	97.15 In/s	13 mS	1	2
R	124. mS	1.97 g's	11.58 g's	144.62 In/s	13 mS	1	2

PEAK G RESULTANT VALUE = 12 Gs. PEAK G (+Z) = 11 Gs.
ACCELEROMETER OUTPUT: CH1 - X(long); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - RESULTANT. Aft side = dessicant port end.
No visible damage.Maximum drop height attainable for short sides.
ASTM D 4169, ASTM D 6179. ARP 1967.

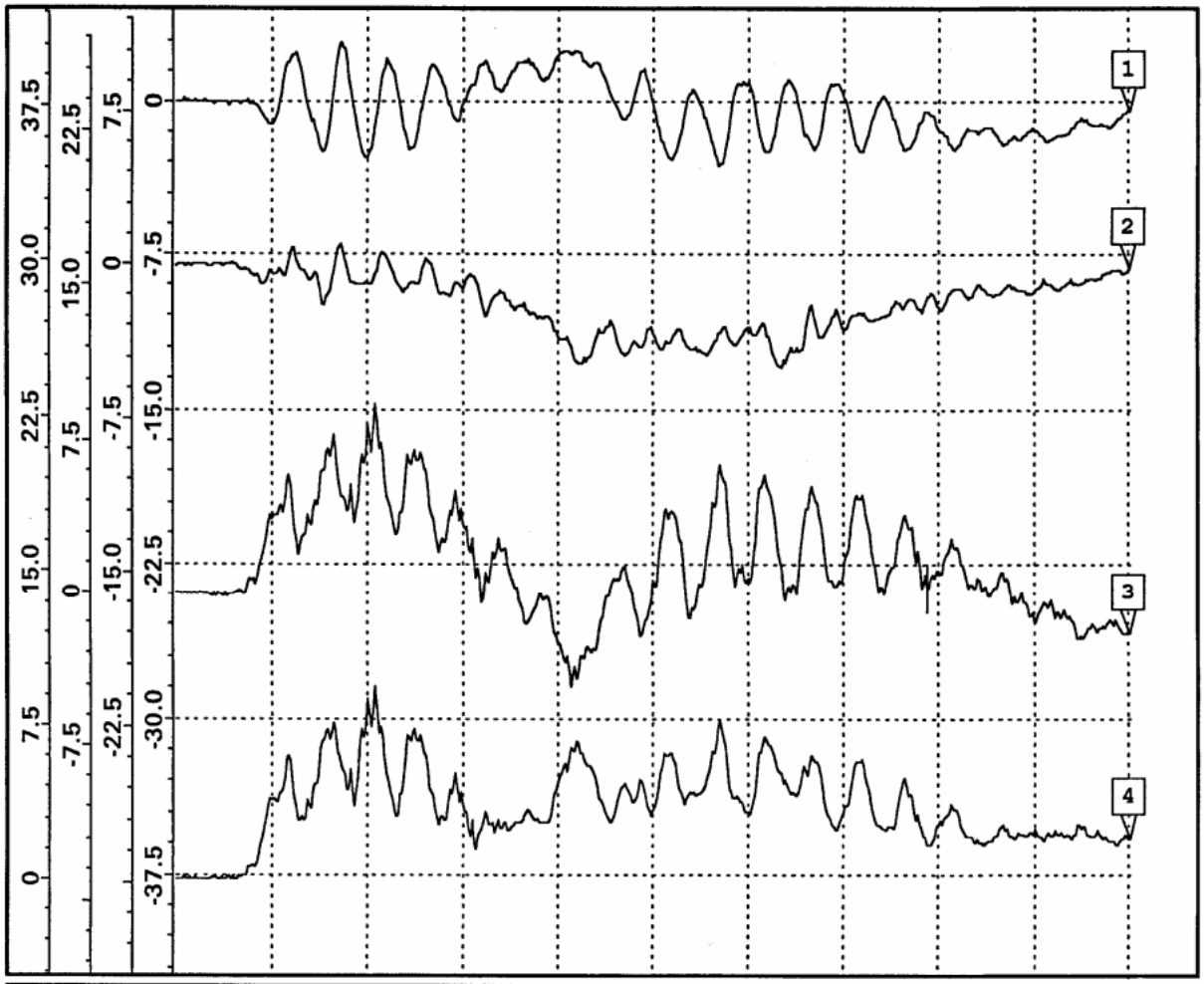
GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

ROTATIONAL IMPACT TESTS

DATE / TIME : Aug 20 2004 7:08
TEST TYPE : Ambient Temp
CONTAINER/ITEM: Al w/ Coil Mounts
TEST ENGINEER : Evans
IMPACT POINT : right edge
DROP HEIGHT : 762 mm (25 inches)

V. Angle: 108.22;H.Angle: 173.09;



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	102. mS	-0.52 g's	-3.28 g's	-1.32 In/s	13 mS	1	2
2	102. mS	-1.56 g's	-5.20 g's	-81.42 In/s	13 mS	1	2
3	102. mS	0.19 g's	9.28 g's	78.87 In/s	13 mS	1	2
R	102. mS	1.66 g's	9.35 g's	113.36 In/s	13 mS	1	2

PEAK G RESULTANT VALUE = 9 Gs. PEAK G (+Z) = 9 Gs.
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - RESULTANT. Aft side = desiccant port.
No visible damage. Maximum drop height attainable for short sides.
ASTM D 4169, ASTM D 6179. ARP 1967.

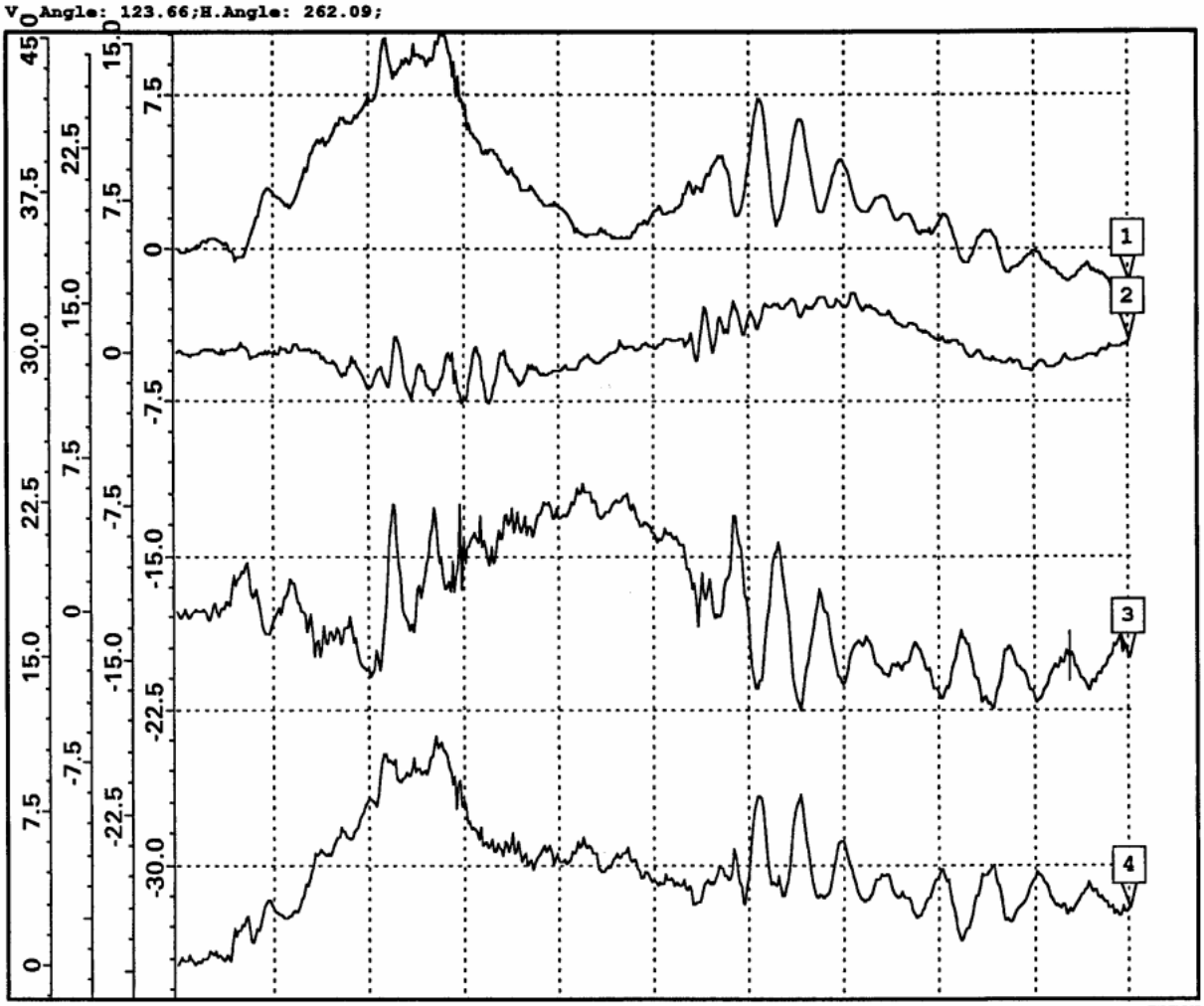
GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

PENDULUM IMPACT TESTS

DATE / TIME :	Aug 20 2004 7:33	TEST ENGINEER :	Evans
TEST TYPE :	Ambient Temp	IMPACT POINT :	forward side
CONTAINER/ITEM:	Al w/ Coil Mounts	IMPACT VELCTY :	2.13 m/sec

V.Angle: 123.66;H.Angle: 262.09;



	Ch.	Time		Curr Amp	Peak Amp	1st Int	Time/Div		Hexp	Vexp
○	1	122.	mS	-1.52 g's	10.59 g's	137.03 In/s	13	mS	1	2
○	2	122.	mS	-0.31 g's	3.14 g's	8.83 In/s	13	mS	1	2
◉	3	122.	mS	-2.26 g's	6.17 g's	17.60 In/s	13	mS	1	2
○	R	122.	mS	2.77 g's	11.24 g's	138.44 In/s	13	mS	1	2

PEAK G RESULTANT VALUE = 11 Gs. PEAK G (X) = 11 Gs.
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - RESULTANT. Aft side = desiccant port end.
No visible damage.
ASTM D 4169, ASTM D 880. ARP 1967.

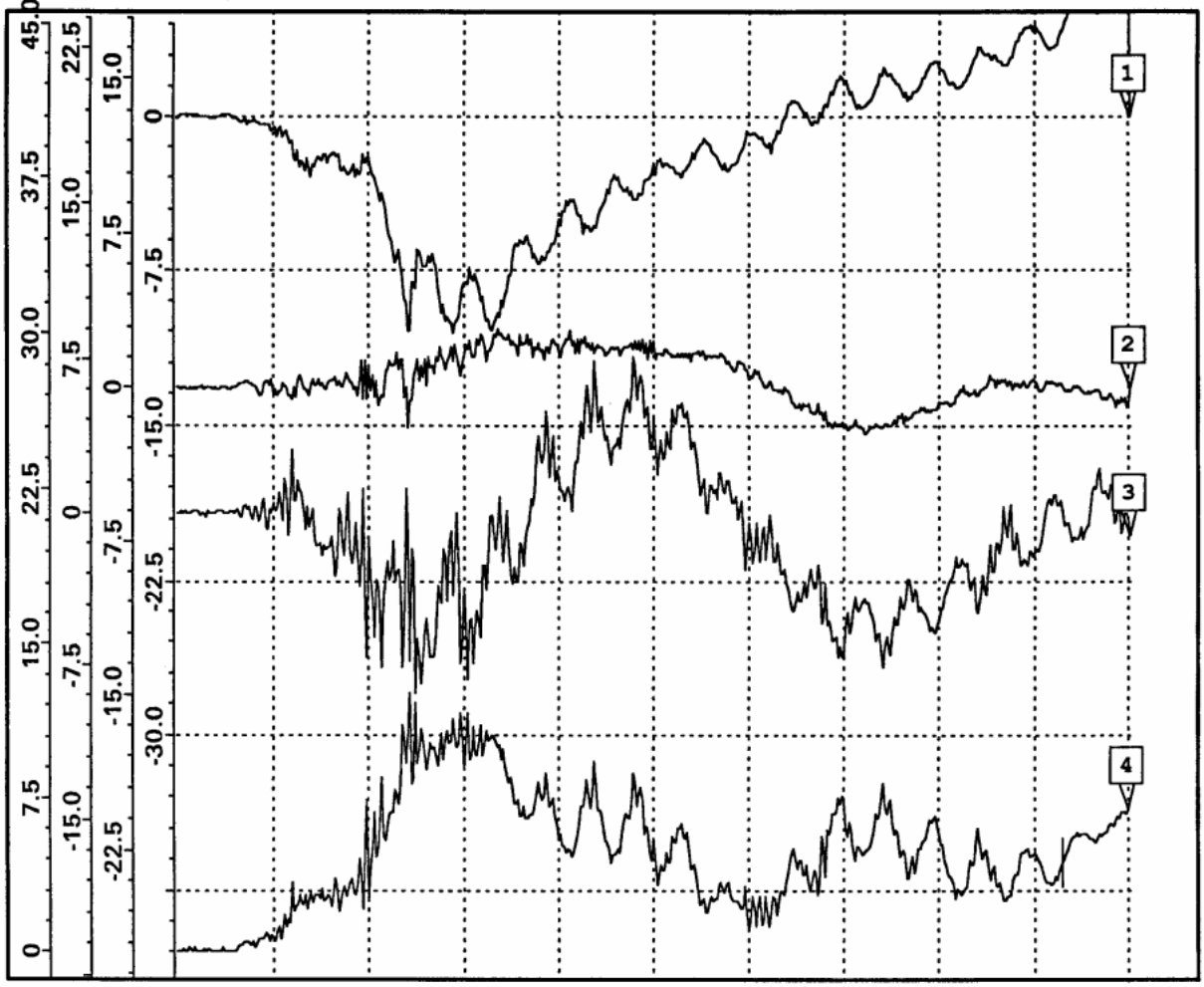
GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

PENDULUM IMPACT TESTS

DATE / TIME :	Sep 8 2004 9:01	TEST ENGINEER :	Evans
TEST TYPE :	Ambient Temp	IMPACT POINT :	aft side
CONTAINER/ITEM:	Al w/ Coil Mounts	IMPACT VELCTY :	2.13 m/sec

V. Angle: 2.46;H.Angle: 13.68;



	Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
◯	1	121. mS	4.20 g's	-10.99 g's	-88.95 In/s	13 mS	1	2
◯	2	121. mS	0.18 g's	2.96 g's	22.88 In/s	13 mS	1	2
◯	3	121. mS	0.04 g's	-8.84 g's	-58.75 In/s	13 mS	1	2
◉	R	121. mS	4.32 g's	13.14 g's	109.03 In/s	13 mS	1	2

PEAK G RESULTANT VALUE = 13 Gs. PEAK G (X) = -11 Gs.
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - RESULTANT. Aft side = desiccant port end.
No visible damage.
ASTM D 4169, ASTM D 880. ARP 1967.

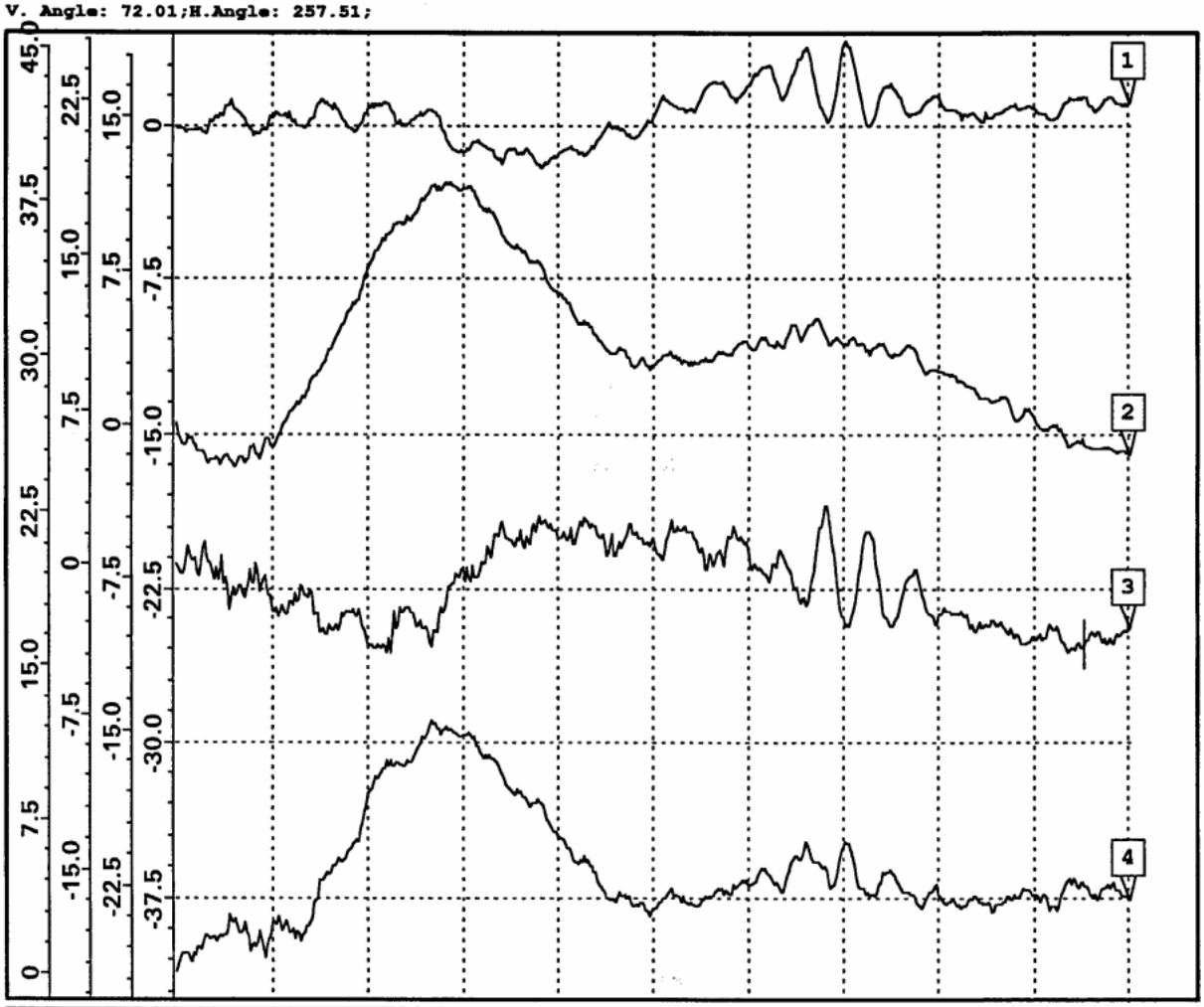
GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

PENDULUM IMPACT TESTS

DATE / TIME :	Aug 20 2004 7:50	TEST ENGINEER :	Evans
TEST TYPE :	Ambient Temp	IMPACT POINT :	left side
CONTAINER/ITEM:	Al w/ Coil Mounts	IMPACT VELCTY :	2.13 m/sec

V. Angle: 72.01;H.Angle: 257.51;



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	124. mS	1.34 g's	4.11 g's	23.53 In/s	13 mS	1	2
2	124. mS	-0.89 g's	11.91 g's	189.33 In/s	13 mS	1	2
3	124. mS	-4.02 g's	-4.57 g's	-46.64 In/s	13 mS	1	2
R	124. mS	4.28 g's	12.42 g's	196.41 In/s	13 mS	1	2

PEAK G RESULTANT VALUE = 12 Gs. PEAK G (+Y) = 12 Gs.
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - RESULTANT. Aft side = desiccant port end.
No visible damage.
ASTM D 4169, ASTM D 880. ARP 1967.

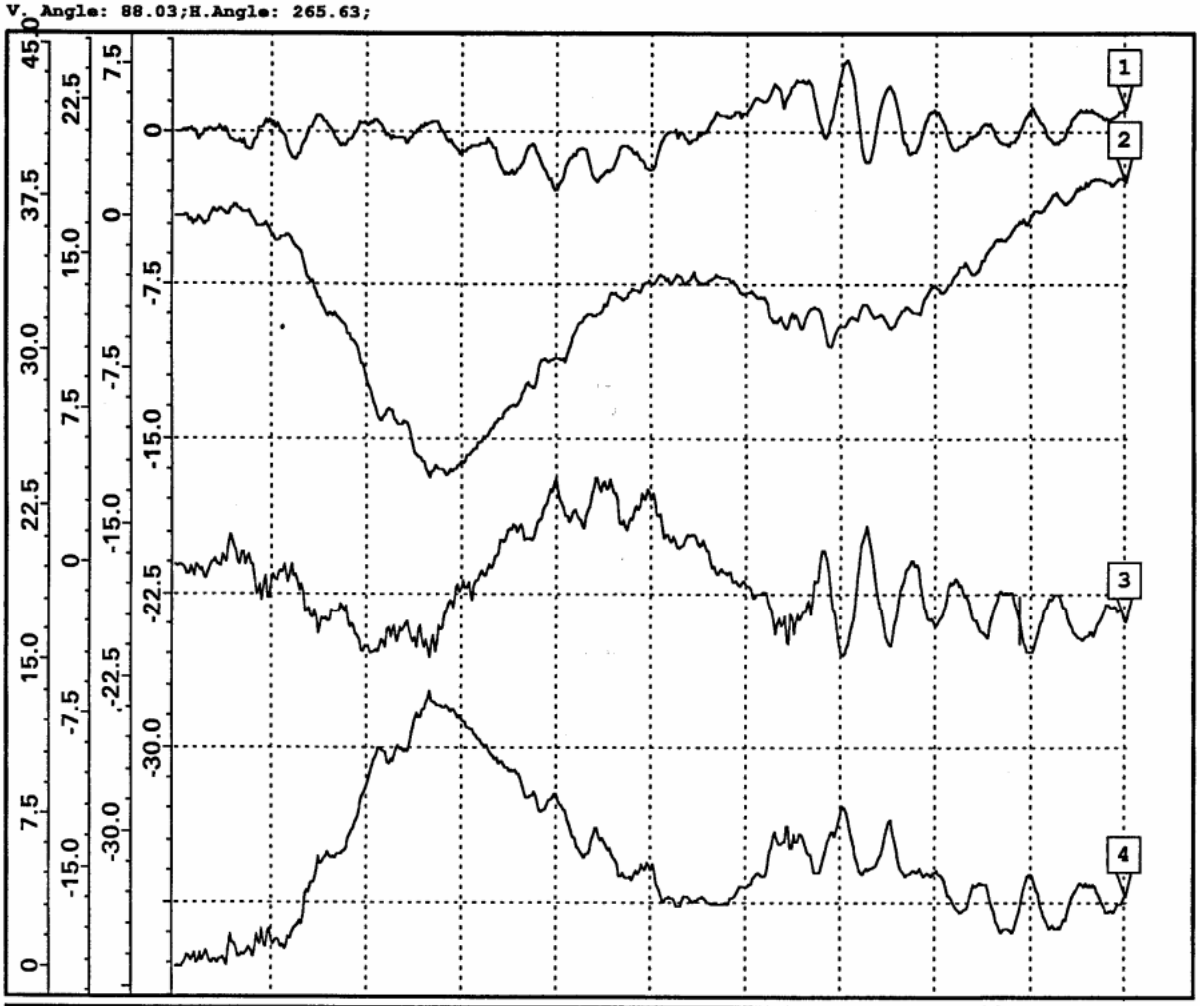
GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

PENDULUM IMPACT TESTS

DATE / TIME :	Aug 20 2004 7:37	TEST ENGINEER :	Evans
TEST TYPE :	Ambient Temp	IMPACT POINT :	right side
CONTAINER/ITEM:	Al w/ Coil Mounts	IMPACT VELCTY :	2.13 m/sec

V. Angle: 88.03;H.Angle: 265.63;



	Ch.	Time		Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
◯	1	115.	mS	0.10 g's	3.76 g's	-2.80 In/s	13 mS	1	2
◯	2	115.	mS	-0.22 g's	-12.75 g's	-217.29 In/s	13 mS	1	2
◉	3	115.	mS	-2.83 g's	-4.77 g's	-33.64 In/s	13 mS	1	2
◯	R	115.	mS	2.85 g's	13.47 g's	219.90 In/s	13 mS	1	2

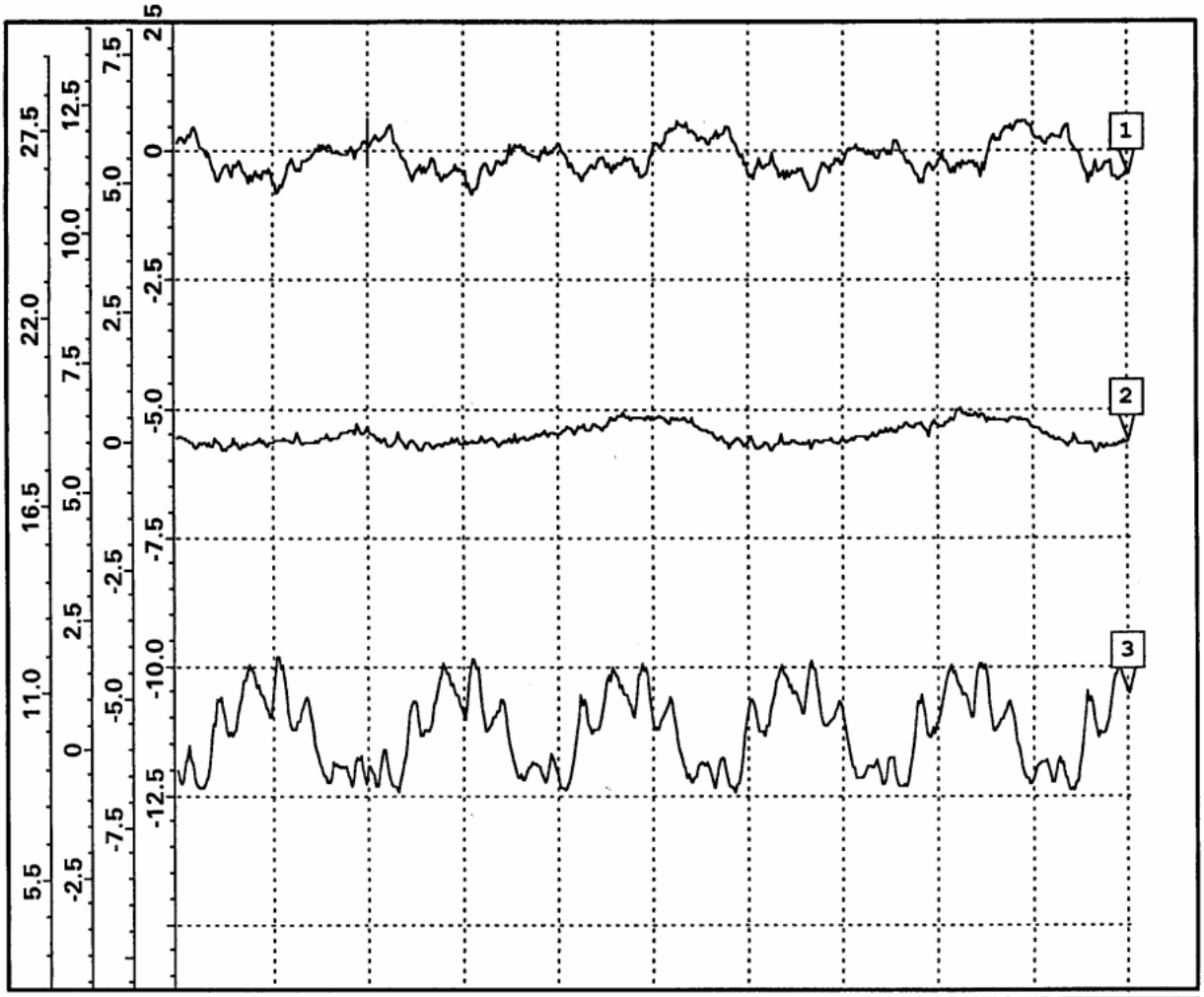
PEAK G RESULTANT VALUE = 13 Gs. PEAK G (Y) = -13 Gs.
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - RESULTANT. Aft side = desiccant port end.
No visible damage.
ASTM D 4169, ASTM D 880. ARP 1967.

GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

REPETITIVE SHOCK TEST

	Sep 3 2004 15:28	TEST ENGINEER :	Evans
TEST TYPE :	Repetitive shock	FREQUENCY :	4.3 Hz
CONTAINER/ITEM:	Al w/ Coil Mounts	Time in test :	5 minutes



	Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
◉	1	261. mS	0.13 g's	-0.93 g's	-18.17 In/s	131 mS	1	2
○	2	261. mS	0.28 g's	0.36 g's	2.32 In/s	131 mS	1	2
○	3	268. mS	-0.47 g's	1.85 g's	27.49 In/s	131 mS	1	2
○	4	258. mS	-0.03 g's	-0.17 g's	-0.70 In/s	131 mS	1	2

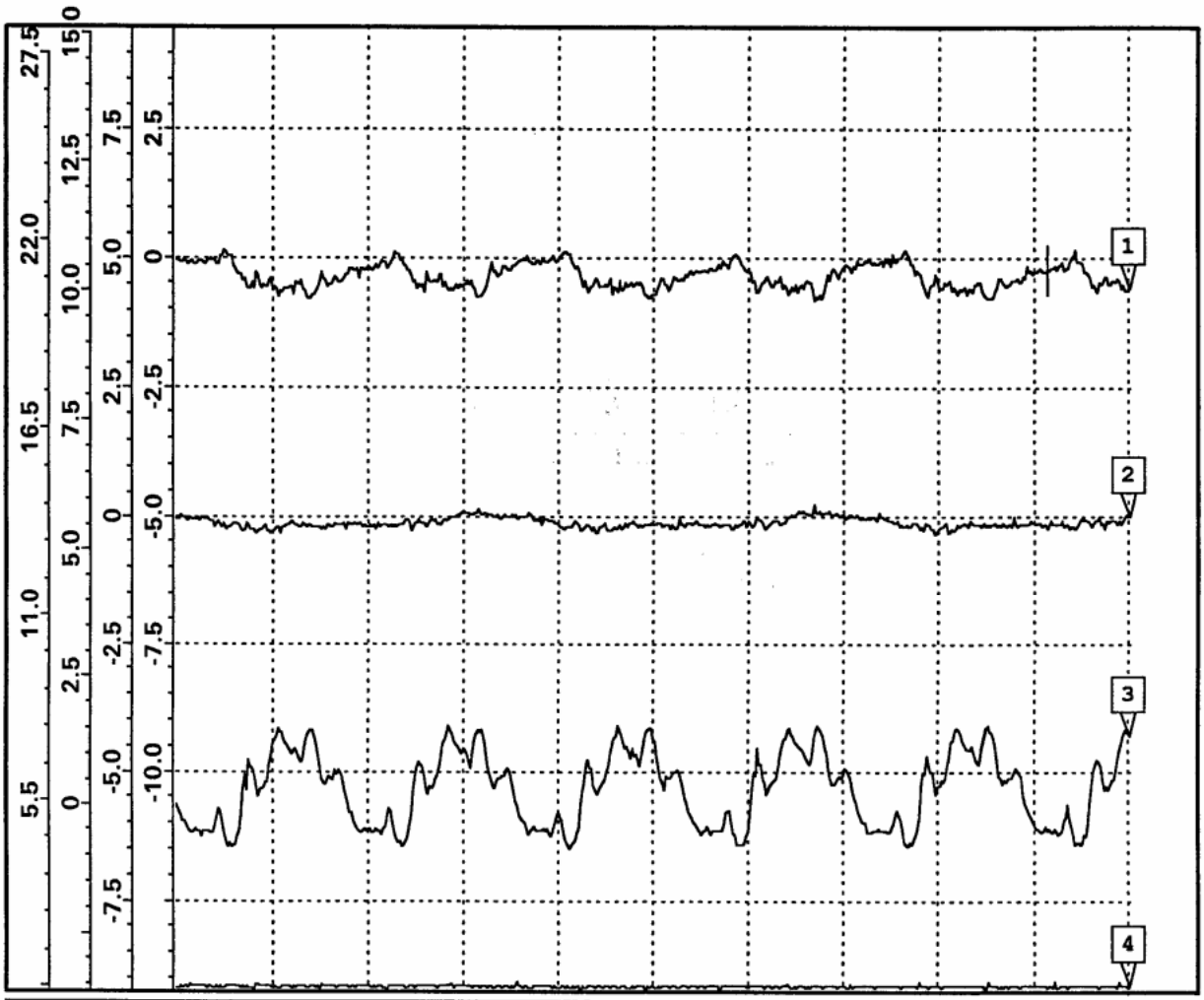
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - unused.
No visible damage.
ASTM D 4169, ASTM D 999, SAE ARP1967.

GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

REPETITIVE SHOCK TEST

	Sep 7 2004 9:08	TEST ENGINEER :	Evans
TEST TYPE :	Repetitive Shock	FREQUENCY :	4.3 Hz
CONTAINER/ITEM:	Al w/ Coil Mounts	Time in test :	60 minutes



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	1.19 S	-0.21 g's	-0.95 g's	-155.73 In/s	131 mS	1	2
2	253. mS	-0.18 g's	-0.42 g's	-14.03 In/s	131 mS	1	2
3	1.26 S	0.68 g's	1.67 g's	131.66 In/s	131 mS	1	2
4	240. mS	0.00 g's	-0.17 g's	-0.38 In/s	131 mS	1	2

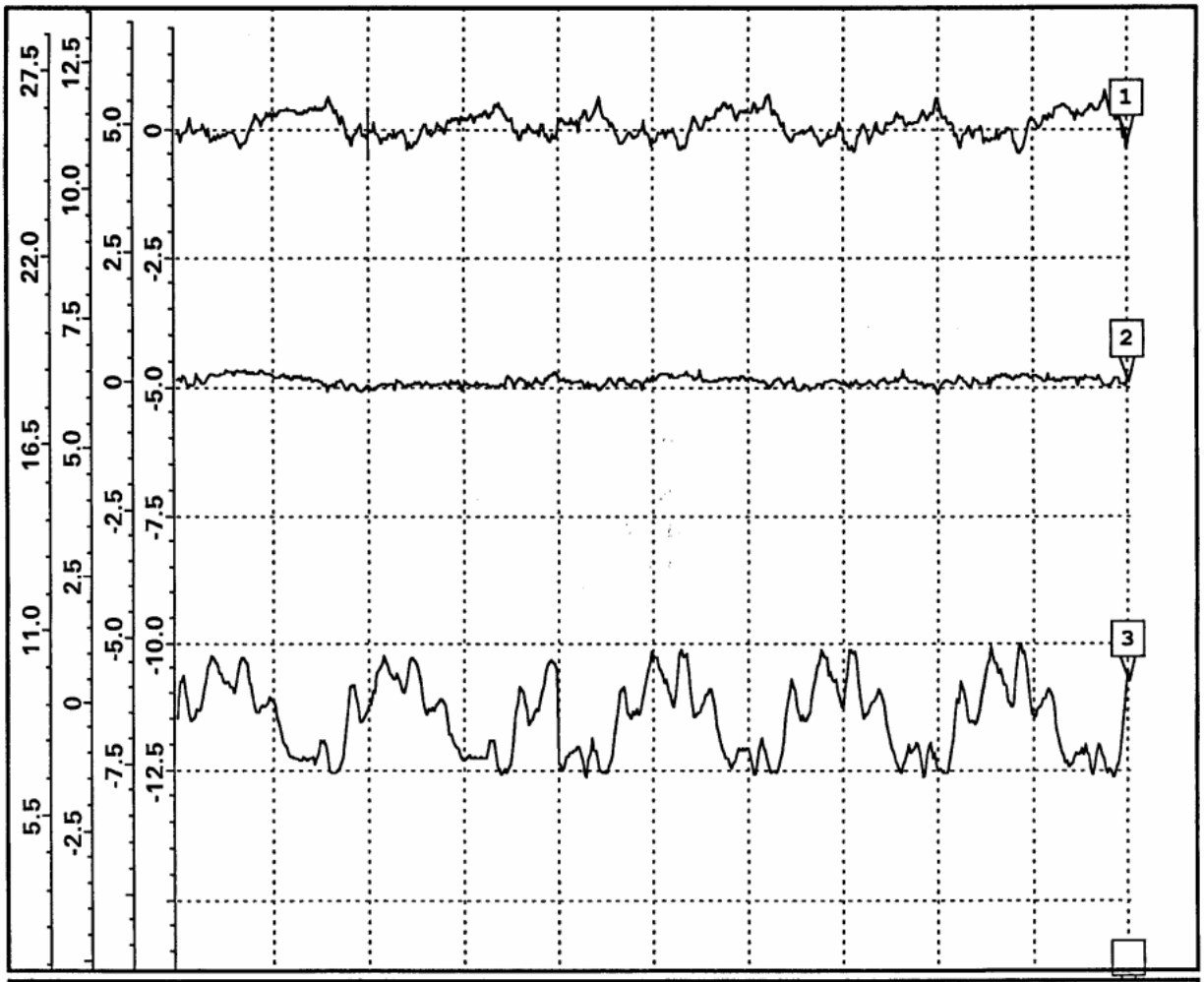
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(long.);
CH4 - not used. Aft side = desiccant port.
No visible damage.
ASTM D 4169, ASTM D 999, SAE ARP1967

GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

REPETITIVE SHOCK TEST

	Sep 7 2004 9:52	TEST ENGINEER :	Evans
TEST TYPE :	Repetitive shock	FREQUENCY :	4.3 Hz
CONTAINER/ITEM:	Al w/ Coil Mounts	Time in test :	90 minutes



	Ch.	Time		Curr Amp	Peak Amp	1st Int	Time/Div		Hexp	Vexp
◉	1	261.	mS	-0.07 g's	0.71 g's	11.97 In/s	131	mS	1	2
○	2	281.	mS	-0.02 g's	0.40 g's	6.13 In/s	131	mS	1	2
○	3	0.00	uS	-0.30 g's	-0.30 g's	0.00 In/s	131	mS	1	2
○	4	261.	mS	-0.14 g's	0.16 g's	-0.02 In/s	131	mS	1	2

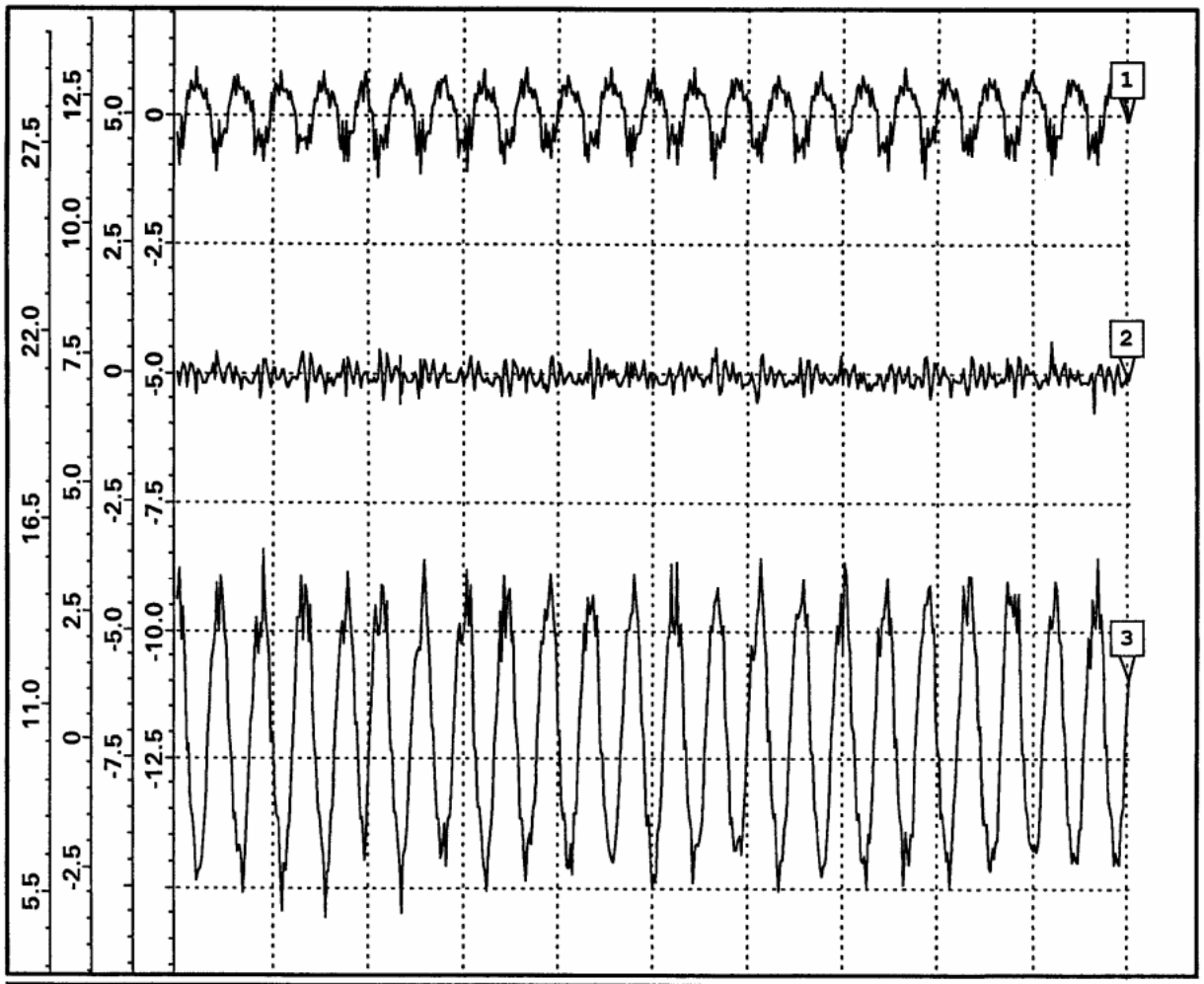
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - unused.
No visible damage.
ASTM D 4169, ASTM D 999; SAE ARP1967.

GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

RESONANCE SWEEP & DWELL

	Sep 3 2004 14:00	TEST ENGINEER :	Evans
TEST TYPE :	Resonance Dwell	FREQUENCY :	~17.3 Hz
CONTAINER/ITEM:	Al w/ Coil Mount	Dwell Time :	3 minutes



	Ch.	Time		Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
○	1	307.	mS	0.57 g's	-1.65 g's	8.45 In/s	131 mS	1	2
◉	2	304.	mS	-0.17 g's	-0.81 g's	-9.10 In/s	131 mS	1	2
○	3	307.	mS	-3.36 g's	3.95 g's	25.87 In/s	131 mS	1	2
○	4	307.	mS	0.02 g's	0.19 g's	0.74 In/s	131 mS	1	2

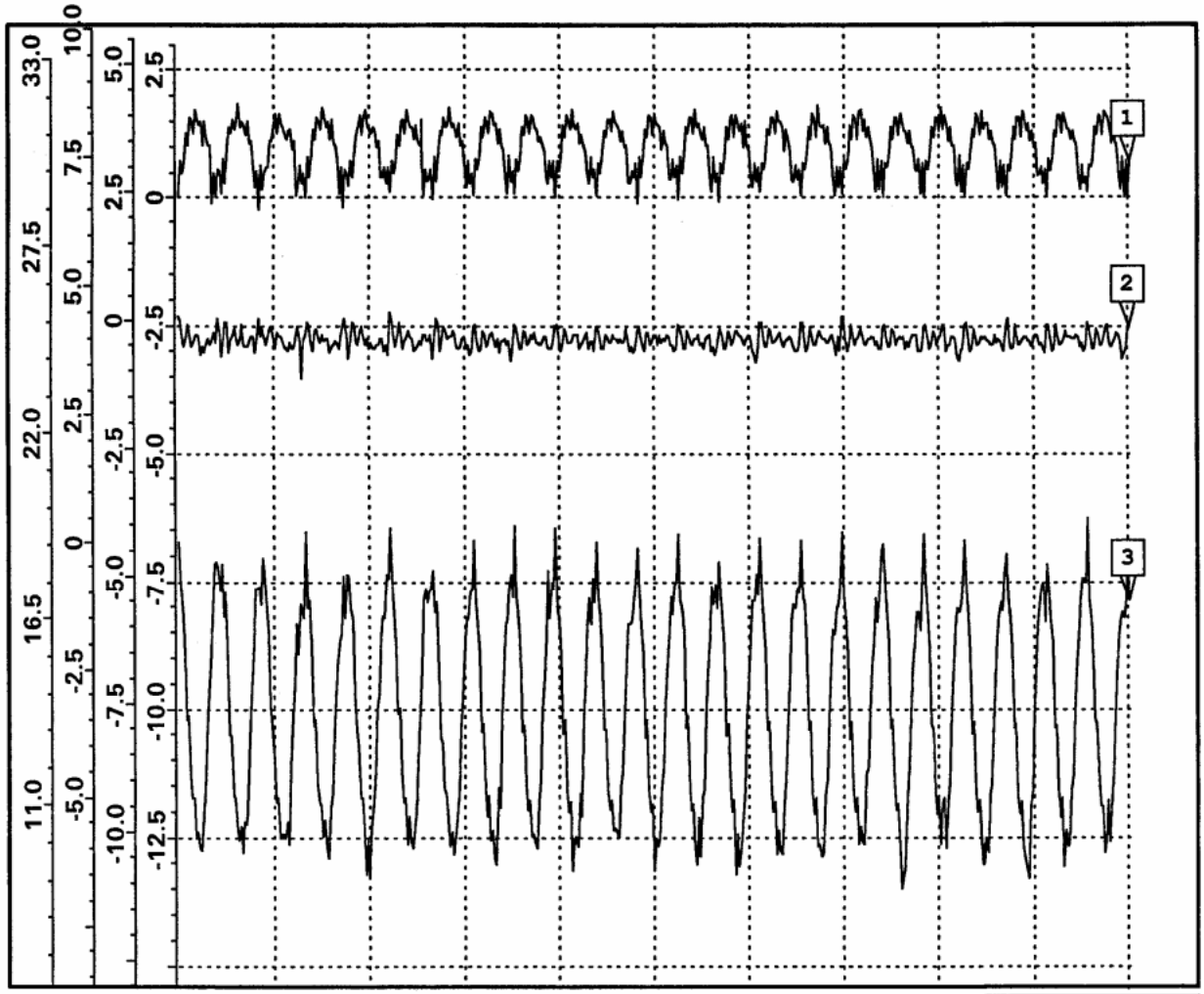
ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - unused.
No visible damage.
ASTM D 4169, ASTM D 999, SAE ARP1967.

GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

RESONANCE SWEEP & DWELL

	Sep 3 2004 14:07	TEST ENGINEER :	Evans
TEST TYPE :	Resonance Dwell	FREQUENCY :	~17.76 Hz
CONTAINER/ITEM:	Al w/ Coil Mounts	Dwell Time :	15 minutes



Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
1	332. mS	1.07 g's	1.96 g's	126.44 In/s	131 mS	1	2
2	330. mS	-0.36 g's	-1.13 g's	-43.95 In/s	131 mS	1	2
3	335. mS	-1.09 g's	-6.89 g's	-438.59 In/s	131 mS	1	2
4	332. mS	0.01 g's	0.17 g's	-0.02 In/s	131 mS	1	2

ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - unused.
No visible damage.
ASTM D 4169, ASTM D 999, SAE ARP1967

GHI SYSTEMS, INC. CAT SYSTEM

C17 Heads Up Display

RESONANCE SWEEP & DWELL

	Sep 3 2004 14:20	TEST ENGINEER :	Evans
TEST TYPE :	Resonance Dwell	FREQUENCY :	~17.69 Hz
CONTAINER/ITEM:	Al w/ Coil Mount	Dwell Time :	30 minutes

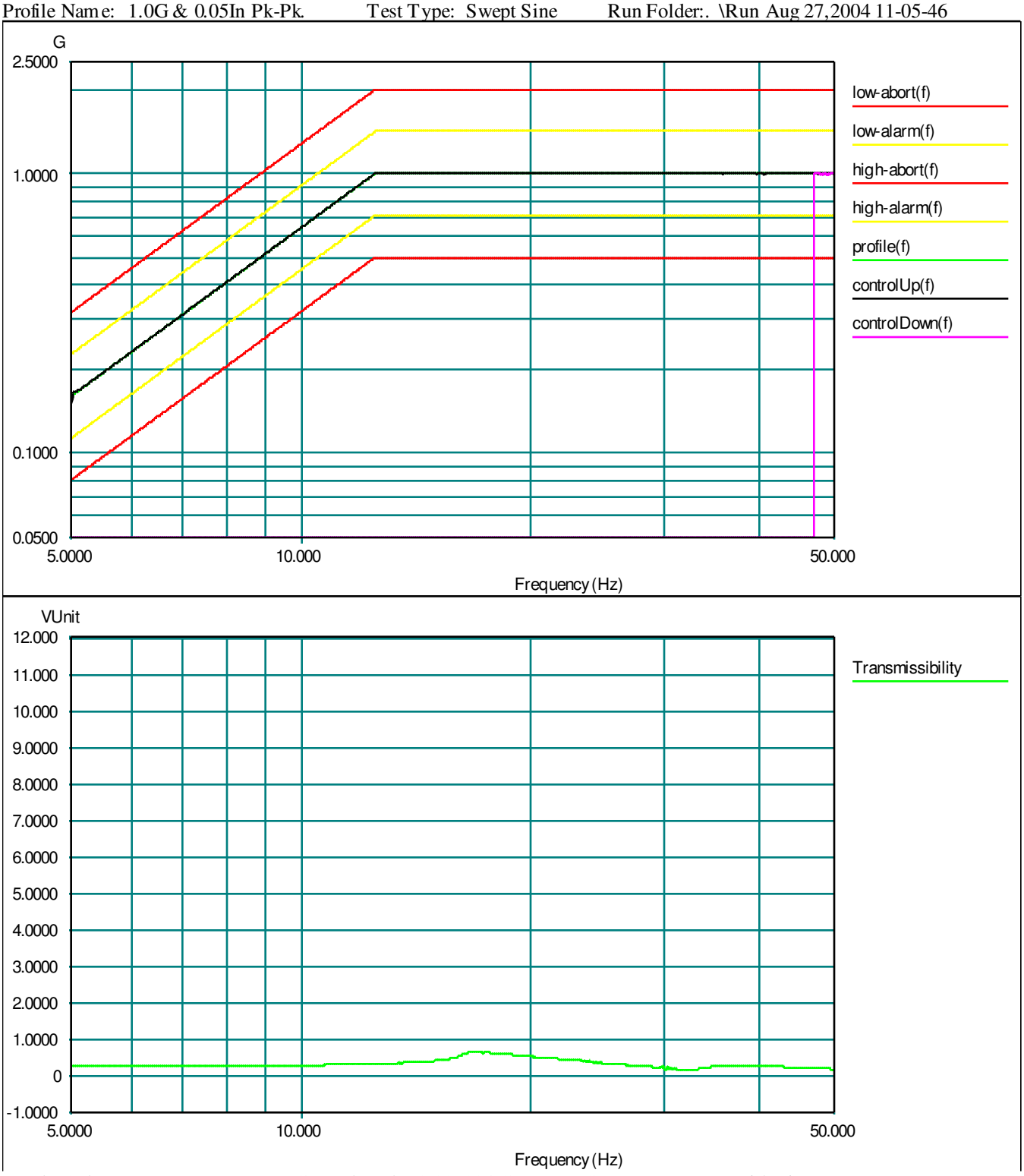
	Ch.	Time	Curr Amp	Peak Amp	1st Int	Time/Div	Hexp	Vexp
◉	1	309. mS	-0.53 g's	-2.00 g's	-80.71 In/s	131 mS	1	2
○	2	353. mS	-0.03 g's	0.69 g's	0.08 In/s	131 mS	1	2
○	3	307. mS	1.00 g's	5.51 g's	227.39 In/s	131 mS	1	2
○	4	309. mS	-0.04 g's	-0.19 g's	-0.75 In/s	131 mS	1	2

ACCELEROMETER OUTPUT: CH1 - X(long.); CH2 - Y(trans.); CH3 - Z(vert.);
CH4 - unused.
No visible damage.
ASTM D 4169, ASTM D 999, SAE ARP1967.

GHI SYSTEMS, INC. CAT SYSTEM

C17 HEADS UP DISPLAY
SINE SWEEP

Test Engineer: Evans
Profile Name: 1.0G & 0.05In Pk-Pk. Test Type: Swept Sine Run Folder:. \Run Aug 27,2004 11-05-46

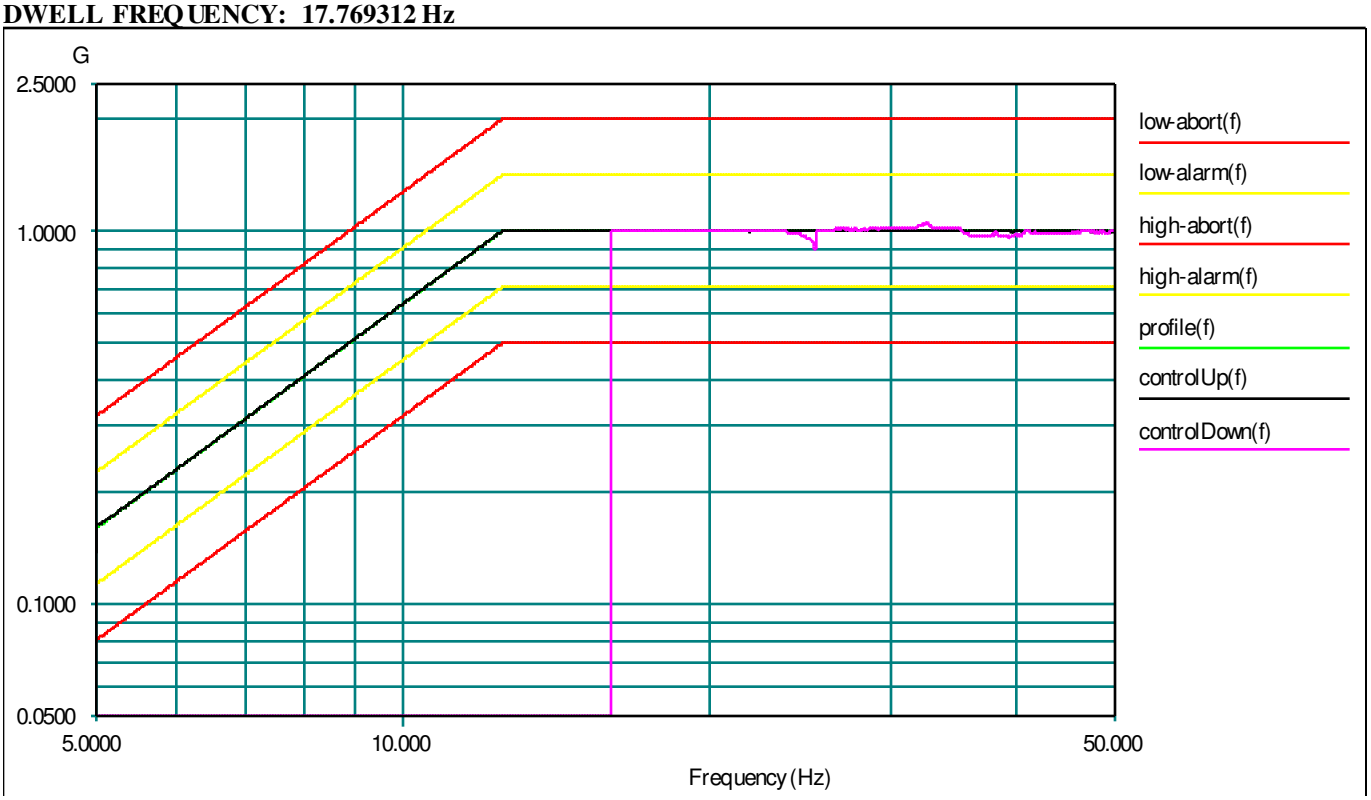


Level: 0 dB Control Peak: 0.997994 G Sweep Type: Logarithmic
Frequency: 47.073368 Hz Demand Peak: 1.000000 G Sweep Rate: 0.5 Oct/Min

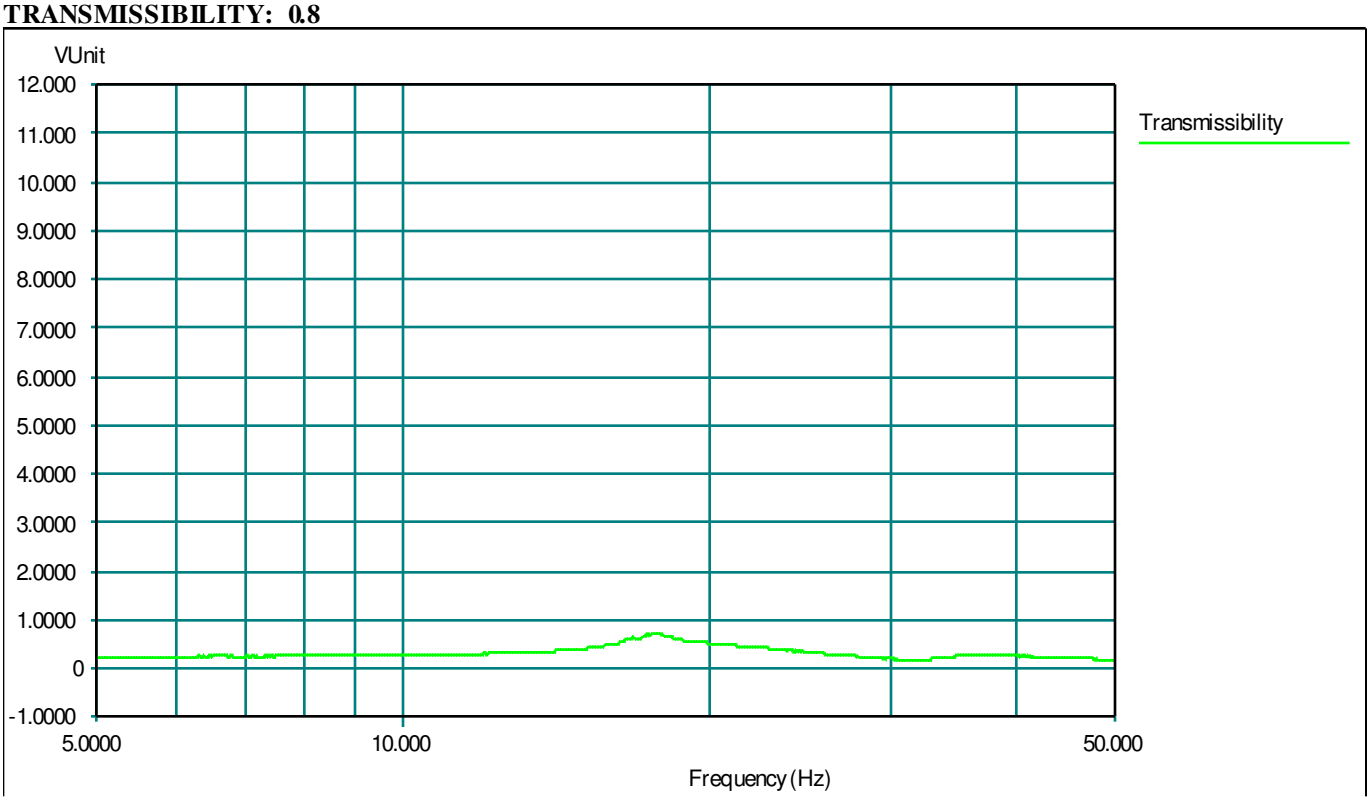
C17 HEADS UP DISPLAY
RESONANCE DWELL

TEST ENGINEER: Evans
Dwell Time: 13 minutes
Profile Name: 1.0G & 0.05In Pk-Pk
Test Type: Sine Dwell
Run: Aug 27,2004 11-30-23

DWELL FREQUENCY: 17.769312 Hz



TRANSMISSIBILITY: 0.8

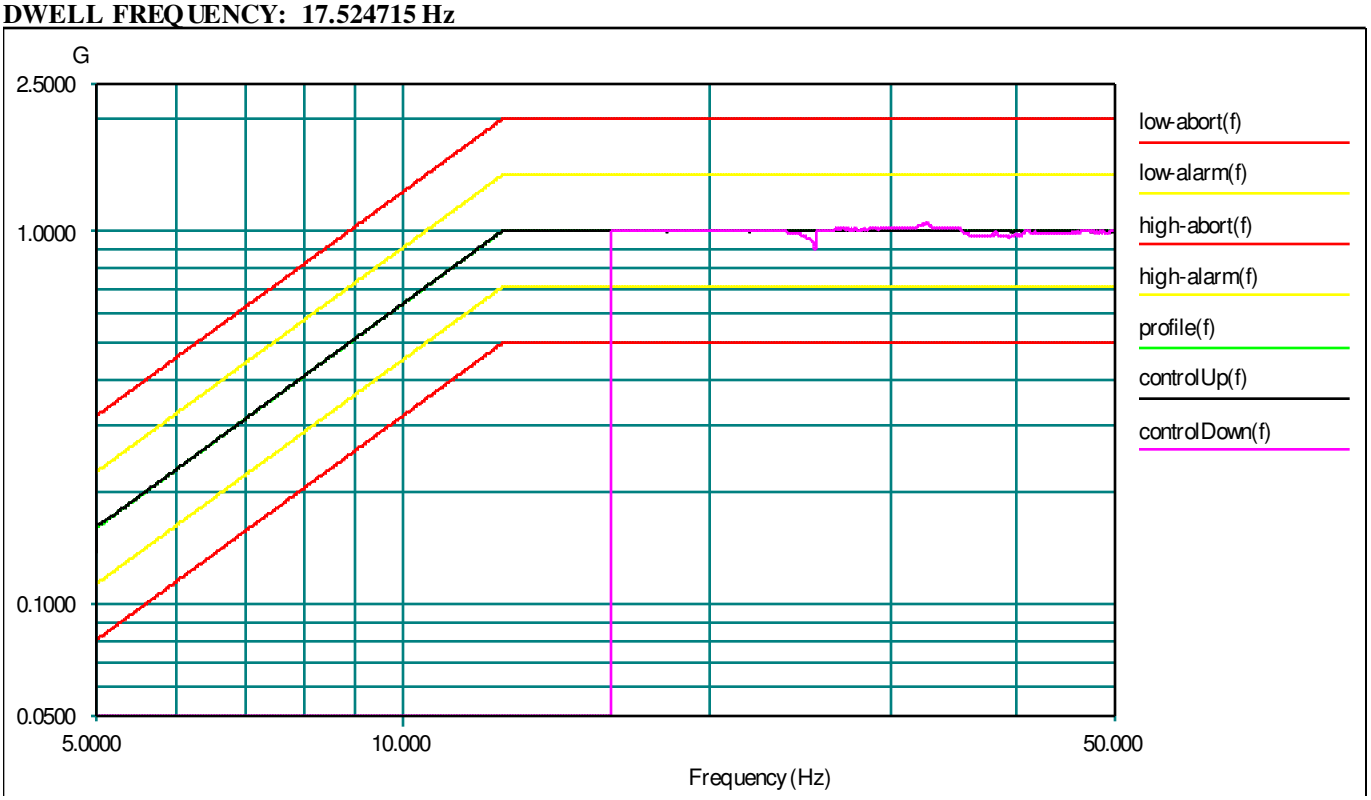


Level: 0 dB
Control Peak: 1.002019 G
Sweep Type: Logarithmic
Frequency: 17.769312 Hz
Demand Peak: 1.000000 G
Sweep Rate: 0.5 Oct/Min

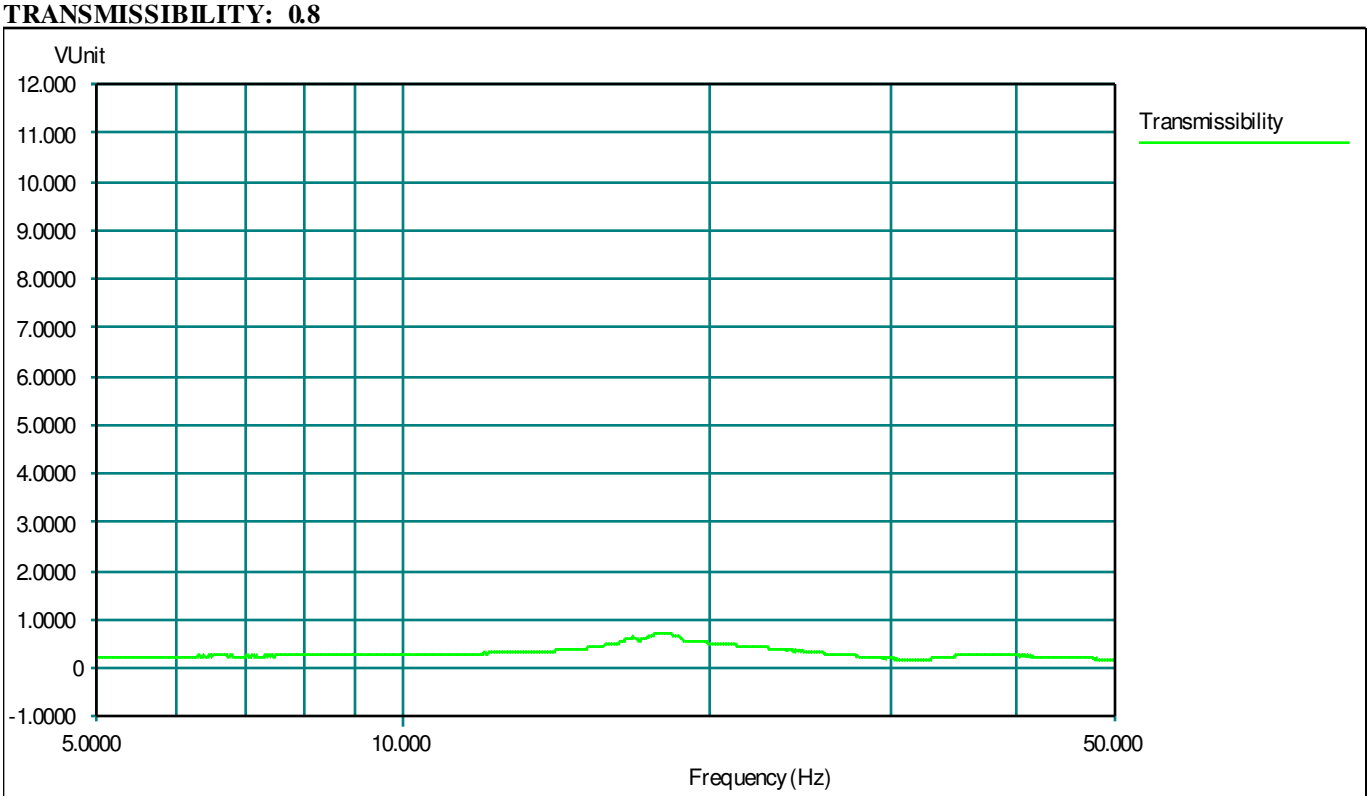
C17 HEADS UP DISPLAY
RESONANCE DWELL

TEST ENGINEER: Evans
Dwell Time: 26 minutes
Profile Name: 1.0G & 0.05In Pk-Pk
Test Type: Sine Dwell
Run: Aug 27,2004 11-30-23

DWELL FREQUENCY: 17.524715 Hz



TRANSMISSIBILITY: 0.8



Level: 0 dB
Control Peak: 1.002019 G
Sweep Type: Logarithmic
Frequency: 17.524715 Hz
Demand Peak: 1.000000 G
Sweep Rate: 0.5 Oct/Min

APPENDIX 4: Test Instrumentation

PRESSURE TEST EQUIPMENT - Test sequence 1 & 6.

EQUIPMENT	MANUFACTURER	MODEL	SN	CAL. DATE
Digtal Manometer	Yokogawa	2655	82DJ6001	N/A

ROUGH HANDLING TEST EQUIPMENT - Test sequences 4 & 5.

EQUIPMENT	MANUFACTURER	MODEL	SN	CAL. DATE
Shock Amplifier	Endevco	2740BT	GB04	Jun 04
Shock Amplifier	Endevco	2740BT	FW23	Jun 04
Shock Amplifier	Endevco	2740BT	FW26	Jun 04
Post Accelerometer	Endevco	2223D	FF67	Jun 03
Data Acquisition	GHI Systems	CAT	Ver. 2.7.1	N/A

VIBRATION TEST EQUIPMENT - Test sequence 2 & 3.

EQUIPMENT	MANUFACTURER	MODEL	SN	CAL. DATE
Servohydraulic Vibration Machine	Team Corp.	Special	1988	N/A
Feedback Hardware Controller	Dactron Corp.	PCI DSP Card Front End DSP Box	2208515 4544828	Aug 04 N/A
Feedback Software Controller	Dactron Corp.	Version 2.1	N/A	N/A
Table Feedback Accelerometer	Endevco	2271AM20	10306	N/A
Feedback Amplifier	Endevco	2775A	EL65	N/A

APPENDIX 5: Distribution List

DISTRIBUTION LIST

DTIC/O
DEFENSE TECHNICAL INFORMATION CENTER
FORT BELVOIR VA 22060-6218

AFMC LSO/LO
WRIGHT-PATTERSON AFB OH 45433-5540

448 MSUG/GBMST
TINKER AFB OK 73145

84 MSUG/GBMUM
HILL AFB UT 84056-5805

542 MSUG/GBMSCA
ROBINS AFB GA 31098-1670

564 ACSS/GFLC (ATTN: Erna Gomez)
44 GREEN STREET, #100
WARNER ROBINS, GA 31093

516 AESG/LGP (ATTN: Stan Smigiel)
2590 LOOP ROAD WEST
WRIGHT-PATTERSON AFB OH 45433-7142

THE BOEING COMPANY
ATTN: GUY BREDESEN M/C C078-0432
2401 E WARDLOW RD
LONG BEACH, CA 90801-5608

APPENDIX 6: Report Documentation

REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (From - To)
27-01-2006	Technical, Final Project Report	May 04 - Sept 04

4. TITLE AND SUBTITLE

Development of the C-17 Heads-Up Display (HUD) Container

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Robbin L. Miller, Project Engineer
robbin.miller@wpafb.af.mil, DSN 787-3362, Comm. (937) 257-3362

Susan J. Evans, Qualification Test Engineer
susan.evans@wpafb.af.mil, DSN 787-7445, Comm. (937) 257-7445

5d. PROJECT NUMBER
04-P-106

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Air Force Packaging Technology and Engineering Facility
AFMC LSO/LOP
5215 THURLOW ST, STE 5, BLDG 70C
WRIGHT-PATTERSON AFB OH 45433-5540

8. PERFORMING ORGANIZATION REPORT NUMBER
06-R-05

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The Air Force Packaging Technology and Engineering Facility (AFPTEF) was tasked with the design of a new shipping and storage container for the C-17 Heads-Up Display (HUD) unit in March of 2004. The new container is designed to replace the wood/fiberboard combination package presently used. The current containers' lack of mechanical and environmental protection as well as handling issues prompted AFPTEF's design of a new container. The new container will protect the HUD both mechanically and environmentally and make it easier to maneuver during worldwide shipment and storage. The CNU-676/E, designed to SAE ARP1967A, is an aluminum, long-life, controlled breathing, reusable shipping and storage container. The new container passed all qualification tests per ASTM D4169. The CNU-676/E container will not only meet the users' requirements but will also provide an economic saving for the Air Force. The savings will be thousands of dollars over the twenty-year life span of the container.

15. SUBJECT TERMS
CNU-676/E, C-17 Heads-Up Display Container, C-17 HUD Container, Aluminum Container, Reusable Container, Design, Test, Long-Life

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Robbin L. Miller
U	U	U	UU	51	19b. TELEPHONE NUMBER (Include area code) (937) 257-3362

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